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EPA Superfund
Record of Decision:

MONTCLAIR/WEST ORANGE RADIUM SITE
EPA ID: NJD98078553
OU 02
ORANGE, NJ
09/14/2005

RECORD OF DECISION

Montclair/West Orange Radium Site
Essex County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York

September 2005

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Montclair/West Orange Radium Site
Essex County, New Jersey

Superfund Identification Number: NJD980785653

Operable Unit 2 - Groundwater

Statement of Basis and Purpose

This decision document presents the selected remedy for groundwater at the Glen Ridge Radium site, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), and to the extent practicable, the National Oil and Hazardous Substances Pollution| Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for the site.

The Information supporting this remedial action decision is contained in the administrative record. The index for the administrative record is attached to this document (Appendix III).

The State of New Jersey concurs with the selected remedy.

Description of Selected Remedy - No Action

The groundwater determination described in this document represents the third and final remedial action decision for the Glen Ridge Radium site. It addresses radon-222 in the groundwater. Previous Records of Decision (RODs), signed on June 30, 1989 and July 1, 1990, addressed radiologically-contaminated soil and debris on residential and municipal properties at the site

Based on the results of the remedial investigation, along with an evaluation of regional groundwater radon data, EPA has determined that the presence of the radon in the groundwater is from natural and anthropogenic background sources including the natural bedrock and widespread deposits of coal ash throughout the area. The quality of the groundwater at the site is consistent with groundwater quality at off-site/background locations. The risks associated with use of the site groundwater, therefore, are in the same range as those estimated, for groundwater regionally and are not related to the CERCLA releases which have been addressed under the previous RODs.

Statutory Determinations

The selected No Action remedy meets the requirements for remedial actions set forth in CERCLA § 121. It is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The principal-threats at the site were addressed through prior actions, which included the removal and off-site disposal of soil and debris contaminated with radionuclides above the established cleanup criteria.

It has also been determined that five-year reviews pursuant to CERCLA § 121(c) will not be required. Radon-222 levels in the groundwater at the site are similar to background or regional levels and are expected to remain essentially unchanged due to the persistent nature of the naturally-occurring radionuclides throughout the area. Any site-related contribution of radon-222 to the groundwater has been removed by the extensive soil cleanup effort completed in December 2004. Therefore, the CERCLA response, action at the site is considered complete.

George Pavlou, Director
Emergency & Remedial Response Division
EPA - Region II

9/14/05
Date

DECISION SUMMARY

Montclair/West Orange and Glen Ridge Radium Site
Essex County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York

September 2005

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SITE NAME, LOCATION AND DESCRIPTION

The Montclair/West Orange and Glen Ridge Radium sites are listed as two sites on the Superfund National Priorities List (NPL) . The two sites include three non-contiguous study areas located in five residential communities of suburban Essex County in northeastern New Jersey (FIGURE 1).

The two study areas cover a land area of approximately 250 acres and include a total of 921 residential and municipal properties. The large majority (i.e., 897) are residential properties. The remaining 24 municipal properties are areas such as city streets and parks. The Montclair study area, encompassing about 100 acres, is depicted in FIGURE 2. The West Orange study area, encompassing about 20 acres, is depicted in FIGURE 3. The Glen Ridge study area, which covers about 130 acres, includes parts of Bloomfield and East Orange. This study area is illustrated in FIGURE 4.

SITE HISTORY

The Radium Industry: Radium research and the radium-products industry were prevalent in northern New Jersey from the early 1900s to the late 1920s as medical, commercial, and military uses were found for the metal. Radium was used to destroy cancerous tissue and was applied as self-illuminating paint in watch and instrument dials, gun sights, and survey equipment. Several companies involved in radium research, radium extraction, and/or radium products were located in the urbanized areas of Essex County during that period. By the early 1930s, increasing awareness of the hazards of radium, and the discovery of richer uranium ore in Africa caused the radium industry to disappear from this area. However, the discarded materials from this industry (process residues, sandy tailings, and even some unused product) are suspected to have been left behind. While some of this waste remained on the factory properties it is believed that other waste materials were carted to rural areas where they were dumped along with other refuse of the time.

Site Development: The land in the center of each of the three study areas was developed after 1920 for residential use. Before development, these "core areas" had been used as disposal sites for coal ash and rubbish. In addition, radium-contaminated waste material apparently was brought to the core areas and placed among the coal ash and other waste. During residential development, channeling and diversion of surface run-off was necessary, and earth was moved during the construction of roads and houses. Contaminated material was mixed with non-contaminated soil and fill material. These materials may have been moved several times since they were first deposited.

Site Discovery: The Montclair/West Orange and Glen Ridge Radium sites were identified as a result of the New Jersey Department of Environmental Protection (NJDEP) program to investigate former radium processing facilities within the state. Realizing that waste could have been disposed at distant locations from these facilities!, NJDEP requested that EPA conduct an aerial gamma radiation survey of a selected area in eastern Essex County. A helicopter survey, conducted in 1981, identified a number of areas with elevated gamma radiation. Ground investigations conducted by NJDEP in 1983 confirmed contamination at both the Montclair and Glen Ridge sites, identifying several houses with gamma radiation and indoor radon decay products above acceptable levels. After a December : 6t, 1983 health advisory issued by the Centers for Disease Control (GDC), EPA began preliminary investigations to assess the extent of radiation contamination at these two locations and also began to implement emergency actions to mitigate the radon and gamma risks.

The West Grange study area, was added to the ongoing investigation in April l984 and, in October 1984, the Montclair/West Orange and Glen Ridg4 Radium sites were proposed to be added to the Superfund National Priorities List. the sites were finalized on the NPL in February 1985. In November 1984, EPA began a comprehensive remedial. investigation and feasibility study (RI/FS). The two sites have been investigated and remediated concurrently since their listing on the NPL.

Soil Cleanup Actions: In May 1984, EPA and NJDEP jointly initiated a pilot study to evaluate the feasibility of excavation and off-site disposal of the radium-contaminated soil. In the fall of 1984, EPA decided to postpone the study because the RI/FS process had been initiated. NJDEP, however, decided to proceed with soil excavation and initiated what came to be known as the "Phase I Cleanup" program. Excavation began in June 1985 after New Jersey contracted with a commercial disposal site in. Nevada. Four properties in Glen Ridge had been completely remediated and four properties in Montclair had been partially remediated when the State of Nevada revoked NJDEP's disposal permit. With no disposal site available, NJDEP was forced to leave soil in containers at its transloading facility in Kearny, New Jersey, and around the four partially-remediated properties in Montclair. In the fall of 1987, NJDEP was finally able to remove the containers of contaminated soil from the partially-excavated properties. The remainder of the soil stored in Kearny was subsequently transported to a disposal facility in Utah during the summer of 1988. The State's Phase I program did provide some useful information about excavation and off-site disposal options.

EPA's draft remedial investigation and feasibility study reports were released in September 1985, before the State's Phase I soil excavation program results were available. At the November 1985 public meeting, EPA indicated that excavation was the preferred remedial alternative but the lack of a disposal facility prevented the selection of such a remedy. From 1985 to 1989, EPA continued to monitor residential properties for excess radon and/or gamma radiation and, because a final remedy was not imminent, initiated additional interim remedial measures, i.e., radon venting systems and gamma ray shielding, at properties with radiation levels above health guidelines. During this period, EPA also continued investigations to further define the extent of soil contamination and continued to seek a disposal site that would accept all of the contaminated material from the two Superfund sites - a much larger volume than was excavated during the NJDEP Phase I program.

The problem of identifying a viable disposal location, either in-or out-of-state, combined with the potential for subsequent denial of a disposal permit, led EPA to a decision to re-examine the 1985 remedial alternatives and search out additional remedies. EPA began a supplemental feasibility study in March 1987 and released the results of this study to the public in April 1989, along with the Agency's proposed remedial approach. EPA's plan called for full soil excavation and off-site disposal for the most highly-contaminated properties at the sites and engineering/institutional controls[1] for the lesser-contaminated properties.

Implementation of the EPA plan would have achieved public health criteria but would have relied on institutional controls to protect public health on the many properties where contamination remained.

[1] Institutional controls are legal or administrative measures, such as property use restrictions, that limit human exposure to hazardous waste or hazardous materials.

Public response to the Proposed Plan for soil remediation was mixed. There was almost unanimous support for the full excavation/off-site disposal component of the remedy; however, numerous reservations were expressed concerning the contaminated soil to be left in place under institutional controls. EPA signed Records of Decision (RODs) for the two sites on June 30, 1989, selecting those measures which were supported by the public. The decision on the properties with contamination left behind was deferred pending additional public comment. The comment period was extended to January 31, 1990. A second set of RODs was subsequently signed on June 1, 1990, which designated full excavation of all contaminated soil exceeding the cleanup criteria for the remaining properties at the sites.

The soil remedial action was implemented in a phased manner that began in 1991 and was completed in December 2004. During the life of the project, more than 220,000 cubic yards of radiologically-contaminated soil and debris were removed for off-site disposal. In all, 897 residential properties and 24 municipal properties (i.e., city streets, parks, lots) have been investigated. Of this total, 340 residential properties and 16 municipal properties required remediation and restoration.

Historical Groundwater Sampling: Groundwater investigations were initiated at the Montclair/West Orange and Glen Ridge sites in February 1984. A total of 16 monitoring wells were installed in the Montclair and Glen Ridge study areas. Monitoring wells were not installed in the West Orange study area at that time because the Town of West Orange denied access.

The first groundwater samples were collected in August 1984. Samples then were collected on a quarterly basis until June 1986. Additional groundwater samples were collected in August 1988. At the time, believing that the contaminated soil represented a much higher risk than the groundwater, EPA decided to focus its efforts on the radiologically-contaminated soil and debris at the sites.

A formal remedial investigation of the groundwater beneath the two Superfund sites was initiated in 1989. The following work was completed from 1989 to 1992:

- Installation of 20 additional monitoring wells, with 4 in Montclair, 10 in West Orange, and 6 in Glen Ridge;
- Slug testing of selected monitoring wells;
- Packer testing of the West Orange Pool well;
- Continuous water level measurements;
- Synoptic water level measurements;
- Two rounds of groundwater sampling; and
- Collection of sediment and surface water samples in boxed culverts/channelized areas.

The 1992 results for the two rounds of groundwater sampling and surface water/sediment sampling are briefly summarized in Section 1.2.3 of the Final Remedial Investigation Report. Data are included in Appendix II of the report.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Proposed Plan addressing the groundwater at the sites was prepared by EPA and released in June 2005. A notice of the Proposed Plan and public comment period was placed in the Newark Star

Ledger on June 25 and 27, and The Montclair Times, The West Orange Chronicle, and The Glen Ridge Paper on June 30, 2005, consistent with the requirements of the National Contingency Plan § 300.430(f)(3)(i)(A). In addition, a flyer announcing the public meeting was distributed to homes affected by the soil remedial action activities. The public notice established a forty-day comment period from June 20, 2005 to July 30, 2005. The Proposed Plan and all relevant documents in the Administrative Record (see Administrative Record Index, Appendix III) were made available to the public at four information repositories, namely: the EPA Superfund Records Center at 290 Broadway, New York, New York 10007; the Montclair Public Library, 50 S. Fullerton Avenue, Montclair, New Jersey 07042; the West Orange Mayor's Office, 66 Main Street, West Orange, New Jersey 07052; and the Glen Ridge Public Library, 240 Ridgewood Avenue, Glen Ridge, New Jersey 07028 (Contact: Reference Desk at the two libraries and the West Orange Public Health Department).

EPA hosted a public meeting on June 29, 2005 at the Nishuane School in Montclair to discuss the Proposed Plan. At this meeting, representatives from EPA and NJDEP answered questions about the contamination at the two Superfund sites and the proposed remedial alternative. In addition, EPA hosted two public availability sessions on July 12 and 13, 2005 at the EPA trailer office compound at 1 Oak Street in Montclair. EPA's responses to comments received during the public meeting and public availability sessions, along with responses to other written comments received during the public comment period, are included in the Responsiveness Summary (APPENDIX iv).

SCOPE AND ROLE OF RESPONSE ACTION

Cleanup at the sites is being addressed by media as soil and groundwater operable units. The soils remedial action, completed in December 2004, included the excavation and off-site disposal of contaminated soil and debris followed by restoration of the excavated areas.

Groundwater is the operable unit addressed in this ROD. Beyond the groundwater, no additional operable units are planned for the sites.

SUMMARY OF SITE CHARACTERISTICS

Site characteristics are described more completely in the RI report, which was finalized by EPA in January 2003. Due to their geographic proximity and similar characteristics, the RI evaluated the two Superfund sites together.

Physical Site Conditions

The topography of the Montclair/West Orange and Glen Ridge Radium sites is governed by the Triassic lowlands of the Piedmont physiographic province and the northeast-southwest trending Watchung Mountains which rise 600 feet above mean sea level (MSL) and about 200 feet above the Triassic lowlands.

Montclair and West Orange are located in the eastern foothills of First Watchung Mountain. Land surface elevations range between 240 and 280 feet above MSL in Montclair and between 270 and 310 feet above MSL in West Orange. The general slope of the Montclair area is to the southeast.

Locally, the terrain slopes toward a depression extending along Nishuane Road and continuing across Virginia Avenue toward Fremont Street. The West Orange area slopes steeply to the southeast. There has been some filling and terracing to decrease the slope in the area nearest Wigwam Brook.

Glen Ridge is located about 7,200 feet east-southeast of First Watchung Mountain. Land surface elevations range between 130 and 190 feet above MSL. The general slope of the Glen Ridge area is to the east, but the terrain also slopes to the south and southwest from a high point located between Victor and Hawthorne Avenues, at the southern edge of the area. Early United States Geological Survey (USGS) topographic maps of the Orange quadrangle (circa 1908, 1913, and 1924) show a stream in the core area of Glen Ridge, which ran east from the corner of Sommer and Hawthorne Avenues through Barrows Field to Brighton Avenue in Bloomfield.

Extensive terracing and filling occurred across the southern half of the area. Victor Avenue is about 20 feet above the adjacent municipal yard which, in turn, is slightly above the adjoining properties on Midland Avenue. The houses on Carteret Street across from Barrows Field are terraced from 4 to 12 feet above the street. The land at the far eastern portion of Barrows Field is built up about 10 feet above the adjoining properties on Midland Avenue.

FIGURE 5 shows the surface water bodies in the area surrounding the Montclair/West Orange and Glen Ridge Radium sites. The shaded regions represent flood hazard areas as identified by the NJDEP Division of Water Resources. Only a small section in the southwest corner of, the Glen Ridge area lies within the flood hazard area. No areas of the Montclair area are affected.

Second River is the principal surface water body in the area. It is fed by Wigwam Brook, which originates in the Watchung Mountains. Wigwam Brook passes through West Orange. About 800 feet to the south of the West Orange area, Wigwam Brook merges with an unnamed stream flowing from the northwest along Eagle Rock Avenue. Upon entering Orange, Wigwam Brook flows east again, passing through East Orange and then north, where it discharges into Second River in Watsessing Park in Bloomfield. The point of discharge for the Second River is the Passaic River on the border of Belleville and Newark.

No surface water flows through either the Montclair or Glen Ridge study areas. Surface drainage from Montclair and Glen Ridge flows in a southeasterly direction and drains into municipal storm sewers that discharge into Wigwam Brook near Main and Washington Streets in West Orange.

Nishuane Brook runs between the Montclair and Glen Ridge investigation study areas. It originates just north of the Montclair area and flows southeast and then south to its confluence with Wigwam Brook. This brook may receive drainage from the southwest portion of the Glen Ridge area. Most surface run-off from Glen Ridge is collected by storm sewers and conveyed east to Wigwam Brook in Watsessing Park. During the remediation of Barrows Field, from 1996 to 1999, a shallow intercept drain (0 to 4 feet) was installed at the eastern end of the field and a deep drainage system (10 to 15 feet) was also installed. Both systems were tied into the Midland Avenue storm sewer.

Two other streams exist in the vicinity but do not flow through the areas. Nishuane Brook originates just north of Montclair and flows southeast and then south along the Montclair and Glen Ridge border, passing between the two study areas. This stream then flows along the East Orange and Orange border and joins Wigwam Brook in East Orange. A second stream, Toney's Brook, also originates north of the Montclair area but flows southeast along Bloomfield Avenue to Glen Ridge. It passes to the northeast of the Glen Ridge area and joins Wigwam Brook in Bloomfield.

Stratigraphy

The stratigraphic section underlying the study areas consists of a layer of unconsolidated glacial sediments and local deposits of fill material overlying siltstones and sandstones of the Brunswick Formation. The Brunswick Formation is part of the Triassic-age Newark Basin, which extends over much of central New Jersey. The stratigraphy of the Newark Basin deposits was redefined in the late 1970s and the Brunswick was renamed the Passaic Formation. Because the term Brunswick Formation has been used in all reports involving the Montclair/West Orange and Glen Ridge Radium sites, it will be retained throughout this document.

Unconsolidated Deposits: The unconsolidated' deposits in the study areas are composed of a sandy glacial till, local deposits of sandy, stratified drift, and fill material. The fill consists of redeposited local soils and cinder, coal ash, glass, slag, clean graded white "sand," and fibrous material. It ranges from a few feet in thickness to as much as 15 feet in the Glen Ridge area. The thickness of unconsolidated deposits ranges from 12.5 to 25 feet in the Montclair area; from 28 to 84 feet in the Glen Ridge area; and from 11.25 to 25 feet in the West Orange area.

A black silt deposit was also noted just above the bedrock beneath Barrows Field in the Glen Ridge study area. This deposit most likely is associated with the former stream that paralleled Carteret Avenue on USGS topographic maps from 1908 through 1925.

Consolidated Deposits: The Brunswick Formation subcrops beneath the study areas; it is composed of thick sequences of siltstones and sandstones. The total thickness of this formation in the study areas is not known; however, it is believed to be more than 6,000 feet thick. The Brunswick Formation dips about 10 degrees to the northwest, and the bedrock surface is higher in West Orange and Montclair than in Glen Ridge, similar to the topography of the sites.

Hydrogeology

Groundwater is present in both the unconsolidated and consolidated layers. These two units, however, are hydrologically connected and do not represent separate aquifer systems. The aquifer is rated as Class 2A by NJDEP, meaning the water is designated as potable.

Unconsolidated Water Bearing Unit: The unconsolidated water bearing unit is generally unconfined; however, there is some evidence of very localized artesian conditions in the stratified drift in parts of Glen Ridge, particularly where filling and terracing have altered the natural slopes. Overall, the there is only a thin, somewhat . discontinuous saturated thickness in the unconsolidated deposits.

Groundwater flow in this unit, based on water level measurements, is to the south-southeast. FIGURES 6 and 7, water table maps, show flow in West Orange and Glen Ridge, respectively.

Shallow wells in Montclair needed to produce water table maps were dry. However, the groundwater in this unit generally flows south/southeasterly toward the local discharge point, most likely Wigwam Brook and Second River, where they flow through Watsessing Park.

There is probably little flux between the water bearing unit and the upper reaches of Wigwam Brook and Nishuane Brook because flow is channelized through concrete culverts in the study areas.

Consolidated Water Bearing Unit: Flow in the Brunswick Formation is primarily associated with subhorizontal, bedding plane fractures. The mean hydraulic conductivity in the unit is 4.3×10^{-4} centimeters per second (cm/sec), based on slug test results. The low conductivity and groundwater gradients limit groundwater flow, which has been estimated locally to move horizontally at roughly one foot per day (ft/d). As in the unconsolidated unit, flow is to the south-southeast.

The vertical component of groundwater flow varies across the area. The data indicate a slight downward gradient to the west that disappears or perhaps becomes a very slight upwards gradient to the east. Vertical flow rates are believed to be significantly less than in the horizontal.

Public Water Supplies

Surface water from reservoirs in northern New Jersey constitutes the major portion of the public water supplies for the towns near the Glen Ridge and Montclair/West Orange Radium sites. However, deep bedrock aquifer wells, outside the boundaries of the sites, are a supplementary source of drinking water.

Montclair: Sources of drinking water in Montclair include rivers, lakes, streams, ponds, reservoirs, springs, and wells. Montclair obtains its primary supply from the North Jersey District Water Supply Commission (NJDWSC). NJDWSC owns and operates the Wanaque and Monksville reservoirs. Montclair pumps its water allocation from these sources of drinking water. Additional water is obtained from three wells within the town, at the following locations, north or northeast of the study area:

- Glenfield well, located on Bloomfield Avenue (206.5 feet deep), 1.2 miles from the Montclair core area (FIGURE 2);
- Lorraine well, located on North Mountain Avenue and Lorraine Avenue (349.7 feet deep), 3.4 miles from the Montclair core area; and
- Rand well, located on North Fullerton Avenue (279.5 feet deep), 2.1 miles from the Montclair core area.

Water produced by NJDWSC is made potable by a major water treatment plant that utilizes pretreatment, sedimentation, filtration, and disinfection. Montclair treats the water from the three wells using chlorine to disinfect the water, aeration to remove volatile organic compounds, and sequestering at the Lorraine well to reduce the hardness of the water.

Glen Ridge: Municipal water for Glen Ridge is supplied by the Town of Montclair.

West Orange: Municipal water for West Orange is supplied by the New Jersey American Water Company. Treated water is purchased from the Passaic Valley Water Commission. In addition, water is obtained from the American Water Canoe Brook treatment plant in Millburn, New Jersey. The water from this treatment plant is a combination of surface water and groundwater pumped from up to 10 wells. None of the wells are located in West Orange.

Bloomfield: Municipal water for Bloomfield is purchased from the Newark Water System. The water is all from surface water sources.

East Orange: Municipal water for East Orange comes from 18 wells completed in the Brunswick Formation located in Milburn and Livingston, 12 miles from East Orange. The wells are on 2,400 acres in Florham Park, in a different watershed than East Orange. East Orange periodically supplements the municipal water with bulk purchases from Newark Water or New Jersey American Water. Both of these suppliers utilize surface water.

Remedial Investigation Groundwater Results

As the soil removal activities neared completion, efforts were resumed to complete the groundwater investigation. Two rounds of sampling were undertaken in 2001.

The field work and sampling performed during the RI characterized the nature and extent of radiological and inorganic contamination in the groundwater at the sites. A general discussion of these findings is presented below. The RI report contains a more complete examination of the analytical results. This information is available in the administrative record (index attached as APPENDIX III).

In addition to the RI, EPA also conducted a Focused Feasibility Study (FFS) for the groundwater. The FFS included an evaluation of radon-222 levels in the Brunswick Formation, the movement of groundwater in the Brunswick Formation, and the fate and transport properties for radon-222 in groundwater.

Groundwater Screening Criteria: Screening criteria were selected to evaluate constituents detected in the groundwater samples. Established regulatory criteria, known as chemical-specific applicable or relevant and appropriate requirements (ARARs), were used to screen the data. Federal and/or State drinking water standards exist for many contaminants. Applicable groundwater screening criteria are listed in TABLE 4. The more stringent of the Federal and State criteria is used as the screening value. EPA's radionuclides final rule was published on December 7, 2000 in the Federal Register as 40 CFR Parts 9, 141, and 142. The final rule did not include a groundwater standard for radon-222, upheld the established maximum contaminant levels (MCLs) for gross alpha and radium-226/radium-228 (combined), and established new standards for gross beta (4 millirems per year) and uranium (30 micrograms per liter [µg/L]) . The final rule recommended that the initial analysis for gross beta be conducted using the picoCuries per liter (pCi/L) unit, for comparison against the screening criterion of 50 pCi/L. The guidance suggested that the typical conversion for the uranium standard to pCi/L is a 1:1 ratio (page 76713). The 50 pCi/L initial screening value for gross beta and the 1:1 unit conversion for uranium were used to evaluate the groundwater data.

As indicated above, there is no Federal or State regulatory standard (or ARAR) for radon-222, the primary contaminant of concern in groundwater at the sites. In November 1999, EPA proposed criteria for radon in drinking water based on findings by the National Academy of Sciences. The proposed criteria included a maximum contaminant level of 300 pCi/L and a higher alternative maximum contaminant level (AMCL) of 4,000 pCi/L.

In selecting an appropriate comparison value to use to determine the need for any additional remedial action at the sites, a number of factors were considered. First, the higher radon-222 AMCL of 4,000 pCi/L falls outside of EPA's acceptable risk range. Consequently, it is not believed to represent an appropriate screening value. In addition, the lower MCL of 300 pCi/L is below the average background level for radon-222 in groundwater in the area. EPA's policy under Superfund is not to establish cleanup goals at concentrations below natural or anthropogenic background levels. This policy is discussed in the following documents: "The Role of Background in the CERCLA Cleanup Program (OSWER 9285.6-07P)" and "The Soil Screening Guidance of Radionuclides: User's Guide, Office of Radiation and Indoor Air (OSWER 9355.4-16A)."

Based on the above, EPA selected background as the appropriate comparison value for radon-222 to determine the need for any additional action at the Montclair/West Orange and Glen. Ridge sites.

Groundwater Sampling: Groundwater samples were collected from 24 monitoring wells and the West Orange pool well. Samples could not be collected from three wells because they were dry and from five other wells because the volume of water was insufficient for measured field parameters to stabilize. Samples were analyzed for selected radionuclide constituents and for Target Analyte List inorganic analytes. TABLES 5 through 8 show all constituents that were detected, with exceedances of regulatory standards highlighted in bold. . Significant detections are summarized below. FIGURE 8 shows all radon-222 detections, and FIGURE 9 shows all lead detections.

General Groundwater RI Findings: In 2001, two rounds of groundwater sampling were performed at the sites. The collected samples indicated the presence of metals and radionuclides.

Total lead was detected above screening criteria in a number of wells. The distribution of the lead detections did not indicate the existence of a definable or organized groundwater plume. The presence of the lead may be attributable, in part, to residual materials from the local radium industry. EPA has undertaken an extensive remedial action in the communities to remove these residual materials so that any further impact on the groundwater from such sources has been mitigated. The scattered lead detections also may be the result of high natural turbidity that was observed in the groundwater samples. Given these considerations, lead is not targeted for remedial action.

Other metals were detected above secondary screening levels including aluminum, iron and manganese. Secondary standards are based on esthetics and taste rather than health concerns. These detections are attributed to natural sources and are consistent with regional data from the Brunswick Formation in many parts of New Jersey. The elevated levels of sodium in several monitoring wells (including a background well) are mostly likely due to the widespread use of road salt in the winter.

Low levels of radionuclides were detected in many of the wells including radium, uranium, gross alpha, gross beta (all below regulatory standards), and radon-222.

Groundwater Radon-222 Findings: Radon-222 was found to be widespread in the groundwater throughout the area. It was detected in both on-site and off-site/background wells. Sampling data obtained from a limited number of off-site monitoring wells during the RI was not considered adequate to fully characterize background radon-222 levels in the groundwater. The known variability in local groundwater radon-222 measurements suggested that the levels needed to be evaluated over a larger or regional area to determine representative background conditions. To augment the RI field effort, sampling data obtained by the USGS in connection with a more comprehensive, regional study of groundwater radon-222 levels were also analyzed. EPA identified a total of 38 wells installed in the Brunswick Formation that were sampled as part of this study. The wells are located at distances between 5 and 16 miles from the sites and are believed to provide better background radon-222 data for comparison to sampling data from on-site wells. Radon-222 concentrations in the USGS wells ranged from 480 to 8,700 pCi/L, with a mean level of 1,881 pCi/L.

The USGS regional well data compares favorably with sampling data from six bedrock wells located more than 200 feet from excavated areas. Radon-222 concentrations in these wells averaged 1,870 pCi/L. Radon-222 data from the West Orange pool well, situated about 500 feet from the nearest excavated area and also considered to be in a background location, indicated a mean level of 1,715 pCi/L.

As discussed above, radon-222 was detected in virtually all of the wells that were sampled. For the nine on-site monitoring wells located within or immediately adjacent to areas where soil was removed, radon-222 concentrations ranged from 49 to 2,350 pCi/L, with a mean of 1,503 pCi/L. The highest radon-222 concentration observed in any monitoring well during the RI was 2,450 pCi/L. A comparison of the on-site groundwater sampling data to the regional or background groundwater data presented above shows no distinguishable difference in radon-222 levels.

Sources of Radon-222 in Groundwater: Groundwater in the area of the sites contains radon-222 from a combination of naturally-occurring and man-made sources. Widespread deposits of coal ash are located throughout the area that contain naturally-occurring radionuclides. This coal ash, which can emit radon-222, is believed to be the largest remaining contributor to groundwater radon levels. Although a man-made substance, the coal ash is not related to the radiologically-contaminated residue from the radium industry that existed in the area many years ago. Since it is not site-related, the coal ash is considered an anthropogenic background source of radon-222 in groundwater.

In addition, the natural bedrock contributes to local groundwater radon-222 levels. As such, the bedrock is considered a naturally-occurring background source of radon-222 in groundwater.

Lastly, some portion of the radon-222 may be associated with the discarded material from the local radium industry. This material has been removed, although small amounts of radionuclides are present in residual soil (i.e., discarded material below the EPA cleanup criteria).

Fate and Transport of Radon-222 in Groundwater

As part of its studies, EPA evaluated the fate and transport of radon-222 in groundwater at the sites.

Among other things, the fate and transport evaluation explains why low levels of radon-222 are present in the groundwater, along with the time period such groundwater conditions are expected to continue. It also identifies the geographic area potentially affected by the past dumping of waste materials from the local radium processing industry. In addition, the evaluation documents that it is not technically feasible to restore the groundwater to levels suitable for potable use or even reduce radon levels to any significant degree within a reasonable time period. Some results of this evaluation are discussed below.

Fate: As radionuclides decay through natural processes, they produce daughter products including radon-222. Unlike other radionuclides in the site soils (e.g., radium-226, radium-228, thorium-230, thorium-232), radon-222 is a gas which is mobile and dissolves in groundwater where it can pose a potential risk. Because of the long half-lives of the radionuclides, particularly radium-226, radon-222 will continue to be produced for thousands of years. Some of the radon produced is expected to continue dissolving into the shallow aquifer.

The half-life is the time taken for half of the atoms of a radioactive substance to decay. The half-lives for the radionuclides at the Montclair/West Orange and Glen Ridge sites are:

- Thorium-232 - 1.4×10^{10} years
- Thorium-230 - 7.5×10^{4} years
- Radium-226 - 1,620 years
- Radium-228 - 6.7 years
- Radon-222 - 3.8 days

The thorium-230 to radium-226 to radon-222 decay chain will continue to produce radon-222 for dissolution into local groundwater. Consequently, while radon-222 will break down quickly, the source of the radon-222 will be present in the groundwater over thousands of years. As a result, it is not technically feasible to restore the groundwater to levels acceptable for human consumption or even reduce radon levels to any significant degree. Furthermore, EPA does not believe that restoration under CERCLA would be appropriate since the naturally-occurring and anthropogenic background levels of radionuclides are not part of the CERCLA response action.

Transport: In the fate and transport evaluation, EPA also calculated the distance that radon-222 may migrate from the sites. This distance is calculated using best estimates of the groundwater flow rate underlying the sites, along with the known rate at which radon-222 decays (i.e, its half-life of 3.8 days). To illustrate, aquifer testing determined the groundwater flow rate to be 1.09 ft/day. The length of time required for radon to decay from a hypothetical concentration of 2,000 pCi/L (among the higher levels detected at the sites) to a hypothetical 500 pCi/L (among the lower levels) is 7.6 days. Based on these values, the groundwater would move less than 10 feet before the radon levels would be reduced to 500 pCi/L (assuming no other radon-contributing sources). These calculations indicate that with the local geologic conditions and radon-222 as the contaminant of concern, it would be extremely difficult for the radon to be transported any significant distance from the sites. Consequently, even if there were a site-related contribution to radon in groundwater (which is not indicated by the groundwater radon-222 findings), the contribution would be limited to the approximate areas of contaminated soil removal. The low levels of radon observed in wells outside the study areas are most likely attributable to natural or anthropogenic background conditions (e.g., coal ash, bedrock).

Although the reduction of radon-222 levels in the groundwater would likely not occur naturally for thousands of years, groundwater at the sites is not expected to adversely affect human health or the environment. Groundwater in the overburden (i.e., subsurface soil) and shallow bedrock aquifer near the sites is currently not used as a potable water source and is not expected to be developed for water supply purposes in the future because of low aquifer yields and high turbidity levels. All potable water in the affected towns is supplied by public water companies. Further, if the groundwater were to reach the surface by natural or man-made forces, the radon gas would volatilize to the atmosphere and be rapidly dispersed.

Ecology and Cultural Resources

The area in the vicinity of the sites is primarily residential, with homes on lots generally one-quarter acre or smaller in size. There is also some commercial development. The sites contain no ecological resources because of the densely-developed residential nature of the area.

A cultural resources survey was not conducted for the sites because the area is completely developed as residential or commercial lots.

CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The sites are located in a densely-developed residential area, with lot sizes generally one-quarter acre or smaller. The towns supply drinking water to all homes and residences, as described previously in this document. No residential wells are known to exist in the area and future installation of residential wells is unlikely since the municipalities supply drinking water.

Future use of the sites is expected to remain unchanged.

SUMMARY OF SITE RISKS

A Human Health Risk Assessment (HHRA) was conducted by EPA to provide a quantitative assessment of the health risks to humans under current and future land-use scenarios.

Human Health Risk Assessment

A four-step process is utilized for assessing site-related human health risks for a reasonable maximum exposure scenario: *Hazard Identification* - identifies the contaminants of potential concern (COPCs) at the sites based on several factors such as toxicity, frequency of occurrence and concentration. *Exposure Assessment* - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well-water by which humans are potentially exposed). *Toxicity Assessment* - determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). *Risk Characterization* - summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks. The reasonable maximum exposure was evaluated.

Current Federal guidelines for acceptable exposures are an individual lifetime excess carcinogenic risk in the range of 10^{-4} to 10^{-6} (e.g., a one-in-ten-thousand to a one-in-one-million excess cancer risk) and a health Hazard Index (HI) (which reflects the likelihood for noncarcinogenic effects for a human receptor) equal to or less than 1.0. (An HI greater than 1.0 indicates a potential for noncarcinogenic health effects.)

Hazard Identification

Contaminants of potential concern (COPCs) were identified in the Human Health Risk Assessment conducted as part of the RI. Based on the RI data, COPCs were identified based on the frequency of detection, range of detected concentrations, and relative toxicity of site contaminants. The data from the RI monitoring well sampling were used in the assessment. The chemicals of potential concern include all chemicals detected above screening levels and known human carcinogens, regardless of their source. The essential nutrients (i.e., calcium, magnesium, potassium, and sodium) were not quantitatively addressed as their potential toxicity is significantly lower than other inorganics at the sites, and most existing toxicological data pertain to dietary intake. COPCs were identified for groundwater, including barium, chromium, iron, lead, manganese, zinc, gross alpha, gross beta, radium-226, radium-228, radon-222, thorium-228, thorium-230, uranium-233, uranium-234, uranium-235, uranium-236, and uranium-238. TABLE 11 presents the COPCs.

Exposure Assessment

In the HHRA, contaminants in groundwater at the sites were quantitatively evaluated for potential health threats to the following receptors:

- Future residential users (adults and young children) of groundwater (ingestion, dermal contact and inhalation during showering/bathing); and

- Future worker users of groundwater (ingestion).

The estimates of cancer risk and noncancer health hazard, and the greatest chemical contributors to these estimates were identified.

Exposure routes and human receptor groups were identified and quantitative estimates of the magnitude, frequency, and duration of exposure were made. Exposure points were estimated using the minimum of the 95 percent Upper Confidence Limit (UCL) and the maximum concentration: Chronic daily intakes were calculated based on the Reasonable Maximum Exposure (RME) (the highest exposure reasonably expected to occur at a site) . The intent is to estimate a conservative exposure case that is still within the range of possible exposures. Central Tendency (CT) exposure assumptions were also developed.

A more detailed discussion of the Human Health Exposure Assessment can be found in Chapter 4 of the HHRA Report. TABLE 12 identifies all exposure pathways, media, potential receptors, and the rationale used to select these pathways.

Toxicity Assessment

Current toxicological human health data were provided by the Integrated Risk Information System (IRIS) database, Health Effects Assessment Summary Tables (HEAST), and EPA's National Center for Environmental Assessment. This information is presented in TABLES 13 and 14 for noncarcinogenic toxicity data and TABLES 15 and 16 for carcinogenic toxicity data. For more information on the documented health effects of the COPCs, refer to Section 5 of the HHRA Report.

Risk Characterization

Risk characterization involved integrating the exposure and toxicity assessments into quantitative expressions of risks/health effects. Specifically, chronic daily intakes were compared with concentrations known or suspected to present health risks or hazards.

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = GDI x SF

where:	risk	=	a unitless probability (e. g., $2x10^{-5}$) of an individual's developing cancer
	GDI	=	chronic daily intake averaged over 70 years (mg/kg-day)
	SF	=	slope factor, expressed as $(mg/kg\text{-}day)^{-1}$.

These risks are probabilities that usually are expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$. indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it represents the number of additional cancers that would be expected to be seen if a population is exposed to the contaminants in a manner consistent with the scenario defined in the exposure assessment. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}.

An HI of less than or equal to 1 indicates that the potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ <1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The HI is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI <1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic, noncarcinogenic effects from exposure to all contaminants are unlikely. An HI >1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Noncancer HQ = GDI/RfD

where: GDI = Chronic daily intake averaged over the exposure duration
RfD = reference dose.

GDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

The results of the risk characterization are presented below and summarized on TABLES 17 and 18.

Risks to Residential Users of Groundwater: Because the groundwater beneath the sites is classified by New Jersey for use as a potable water supply, potential risks were estimated for adult and child residents assuming future exposure to groundwater that is used as tap water. The total RME cancer risk for adult and child resident exposures was 3×10^{-3} (three in one thousand), which exceeds the EPA range of 10^{-6} to 10^{-4}. This risk is primarily associated with inhalation of radon-222 in vapors from groundwater while showering or bathing. However, potential exposures during showering/bathing can vary to a large degree. When CT exposure assumptions (i.e., more typical exposures) are used, the total cancer risk for adult and child residents decreases to 3×10^{-5}, which is within the range of 10^{-6} to 10^{-4}.

Radon in Indoor Air

Radon may be present in indoor air as a result of a number of phenomena. Two of these are particularly significant. First, radon may migrate to indoor air from contaminated soil beneath a home or building. This is the pathway of greater concern at the Montclair/West Orange and Glen Ridge sites and is the mechanism most likely to contribute to indoor air concentrations. However, this pathway was eliminated with the removal of contaminated soil from the sites. Second, radon may move into indoor air from radon-containing groundwater that is used as a potable water source, through activities such as showering and bathing, washing dishes or laundry, and the flushing of toilets. Although also a significant pathway, it represents by far the lesser of the two pre-cleanup contributions of radon to indoor air at the sites. In fact, the National Academy of Sciences, based on its own study, predicted that the average radon-222 concentration in indoor air from tap water is about one ten-thousandth of the radon concentration in the tap water itself (i.e., a tap water radon concentration of 10,000 pCi/L would produce an average radon concentration in indoor air of only about 1 pCi/L).

The total RME hazard index (HI) for both adult and child residents exceeded the threshold of 1 for noncancer effects (HI of 1.6 for adults and 3.7 for children), indicating that noncancer health effects may occur from RME future exposures to groundwater by residents. When the hazard index is broken out by target organ, the hazard index exceeded unity for effects to the gastrointestinal (GI) tract for adults and to the liver and GI tract for children. Noncancer effects to the GI tract and liver were associated mostly with naturally-occurring iron (HI of 1.1 for the GI tract for adults and 2.3 for the GI tract/liver for children). When CT exposure assumptions are used, the hazard indices for adult and child residents still exceeded the threshold of one (i.e., 1.1 for adults and 1.5 for children).

Summary of Site Risks

The results of the baseline risk assessment indicate that the groundwater at the sites poses a risk to human health through inhalation of radon-222 vapors during showering or bathing. However, radon-222 levels in the groundwater beneath the sites are consistent with regional or background groundwater radon-222 levels. The risks associated with use of the site groundwater, therefore, are in the same range as those estimated for the off-site groundwater. These risks are not related to the CERCLA releases, which have been addressed.

Any site-related risks to public health have been mitigated by the removal of the radiologically-contaminated soil, which eliminated the major source of indoor radon-222 exposures at the sites. This action also served to eliminate the site-related contribution of radon-222 to the groundwater. In addition, all homes in the communities that comprise the sites are supplied with public water. Since the shallow groundwater beneath the sites is not used for household purposes, this indoor air radon exposure pathway also does not exist. A full evaluation of risks associated with background levels of radon-222 is included in Appendix A of the FFS.

Discussion of Uncertainties in Risk Assessment

The procedure and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis;
- environmental parameter measurement;
- fate and transport modeling;
- exposure parameter estimation; and,
- toxicological data.

Uncertainty in environmental sampling arises, in part, from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry-analysis error can stem from several sources, including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the contaminants of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the contaminants of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the baseline human health risk assessment provides upper-bound estimates of the risks to populations at and near the sites, and it is highly unlikely to underestimate actual risks related to the sites.

Specifically, several aspects of risk estimation contribute uncertainty to the projected risks. EPA recommends that an arithmetic average concentration of the data be used for evaluating long-term exposure and that, because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent UCL on the arithmetic average be used as the exposure point concentration. The 95 percent UCL provides reasonable confidence that the true average will not be underestimated. Exposure point concentrations were calculated from residential, monitoring well, surface water and sediment sample data sets to represent the RME to various current and future populations. Uncertainty associated with sample laboratory analysis and data evaluation is considered low as a result of quality assurance and data validation.

In addition to the calculation of exposure point concentrations, several site-specific assumptions regarding future land use scenarios, intake parameters, and exposure pathways are a part of the exposure assessment stage of a baseline risk assessment. Assumptions were based on site-specific conditions to the greatest degree possible, and default parameter values found in EPA risk assessment guidance documents were used in the absence of site-specific data. However, there remains some uncertainty in the prediction of future use scenarios and their associated intake parameters and exposure pathways. The exposure pathways selected for current scenarios were based on the site conceptual model and related RI and FS data. The uncertainty associated with the selected pathways for these scenarios is low because site conditions support the conceptual model.

Standard dose conversion factors, risk slope factors, and reference doses are used to estimate the carcinogenic and noncarcinogenic hazards associated with site contaminants. The risk estimators used in this assessment are generally accepted by the scientific community as representing reasonable projections of the hazards associated with exposure to the various chemicals of potential concern.

SUMMARY OF SELECTED NO ACTION REMEDY

Based on the results of the remedial investigation and other evaluations, the Selected Remedy for the groundwater at the Montclair/West Orange and Glen Ridge sites is No Action.

EPA's past actions addressed any potential site-related source of radon-222 in groundwater. Natural and anthropogenic background sources throughout a widespread area contribute to the presence of radon in the groundwater at levels which are outside of EPA's acceptable risk range. However, the groundwater at the sites is not used as a source of drinking water and is not expected to be developed for such purposes in the future. Public sources supply potable water to all residents in the affected communities. Thus, there is no public exposure to the groundwater.

EPA believes that the Selected Remedy, which addresses CERCLA releases, would be protective of human health and the environment, would comply with ARARs, is consistent with CERCLA and Superfund policy, would be easily implementable, and would be cost-effective.

STATE CONCURRENCE

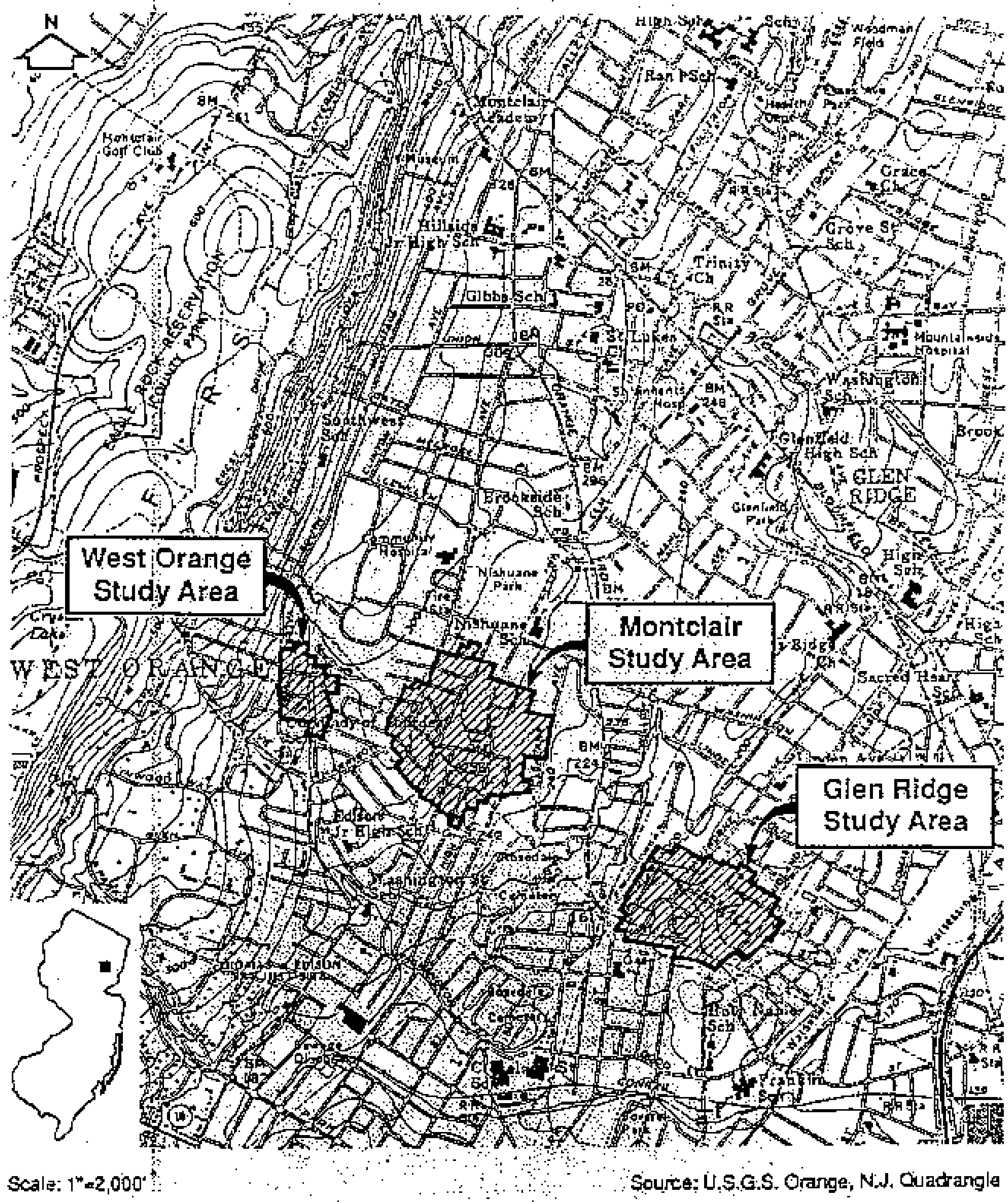
The State of New Jersey concurs that no further action pursuant to CERCLA is appropriate for the sites and that the levels of radon-222 in the groundwater are in the range of natural background. However, NJDEP may explore the need for institutional controls for the groundwater in the future independent of EPA and the CERCLA process.

DOCUMENTATION OF SIGNIFICANT CHANGES

There were no significant changes from the preferred remedy presented in the Proposed Plan.

APPENDIX I

FIGURES



CDM

FIGURE 1
LOCATION OF THE THREE STUDY AREAS

MONTCLAIR/WEST ORANGE & GLENRIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

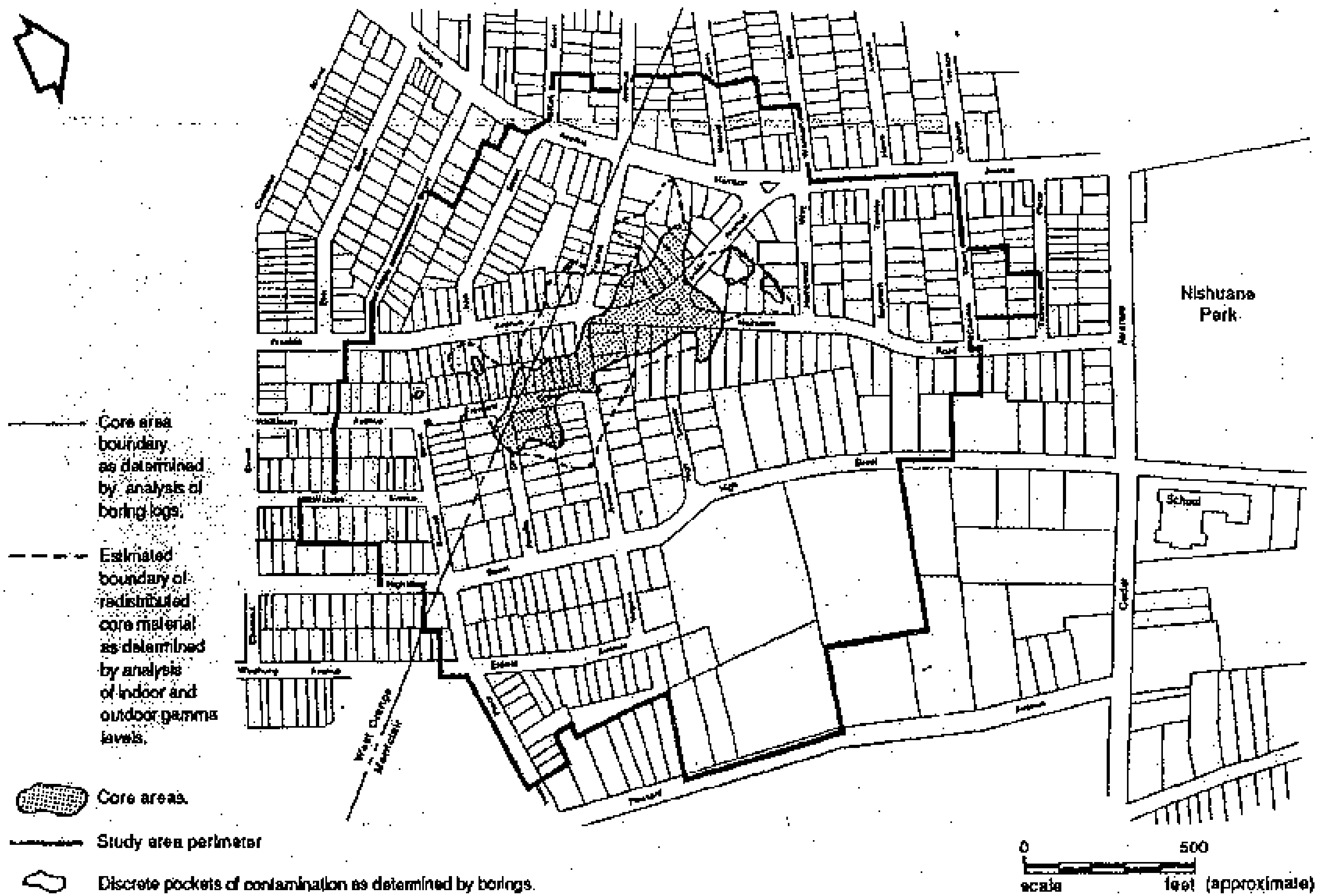


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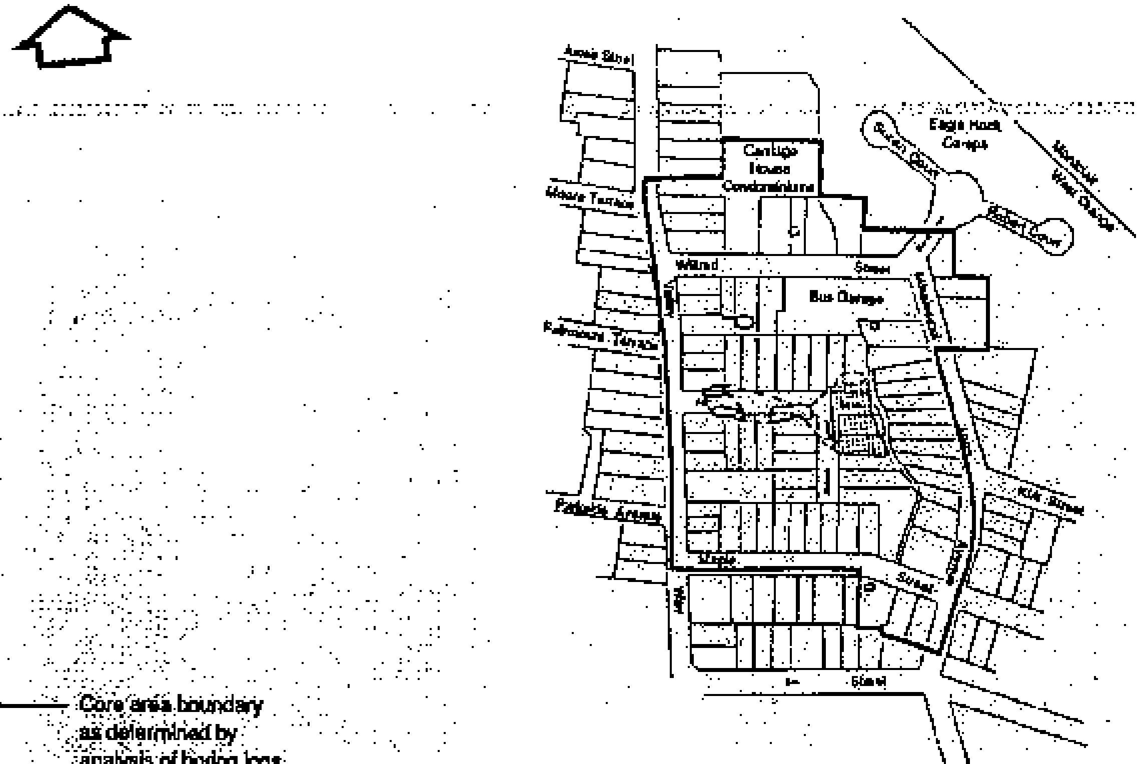
FIGURE 2
MONTCLAIR STUDY AREA

MONTCLAIR/WEST ORANGE & GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY



Core area boundary as determined by analysis of boring logs.

Estimated boundary of redistributed core material as determined by analysis of indoor and outdoor gamma levels.

Core areas.

Study area perimeter

Discrete pockets of contamination as determined by borings.

0 500
scale feet (approximate)

CDM

FIGURE 3
WEST ORANGE STUDY AREA

MONTCLAIR/WEST ORANGE & GLENRIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

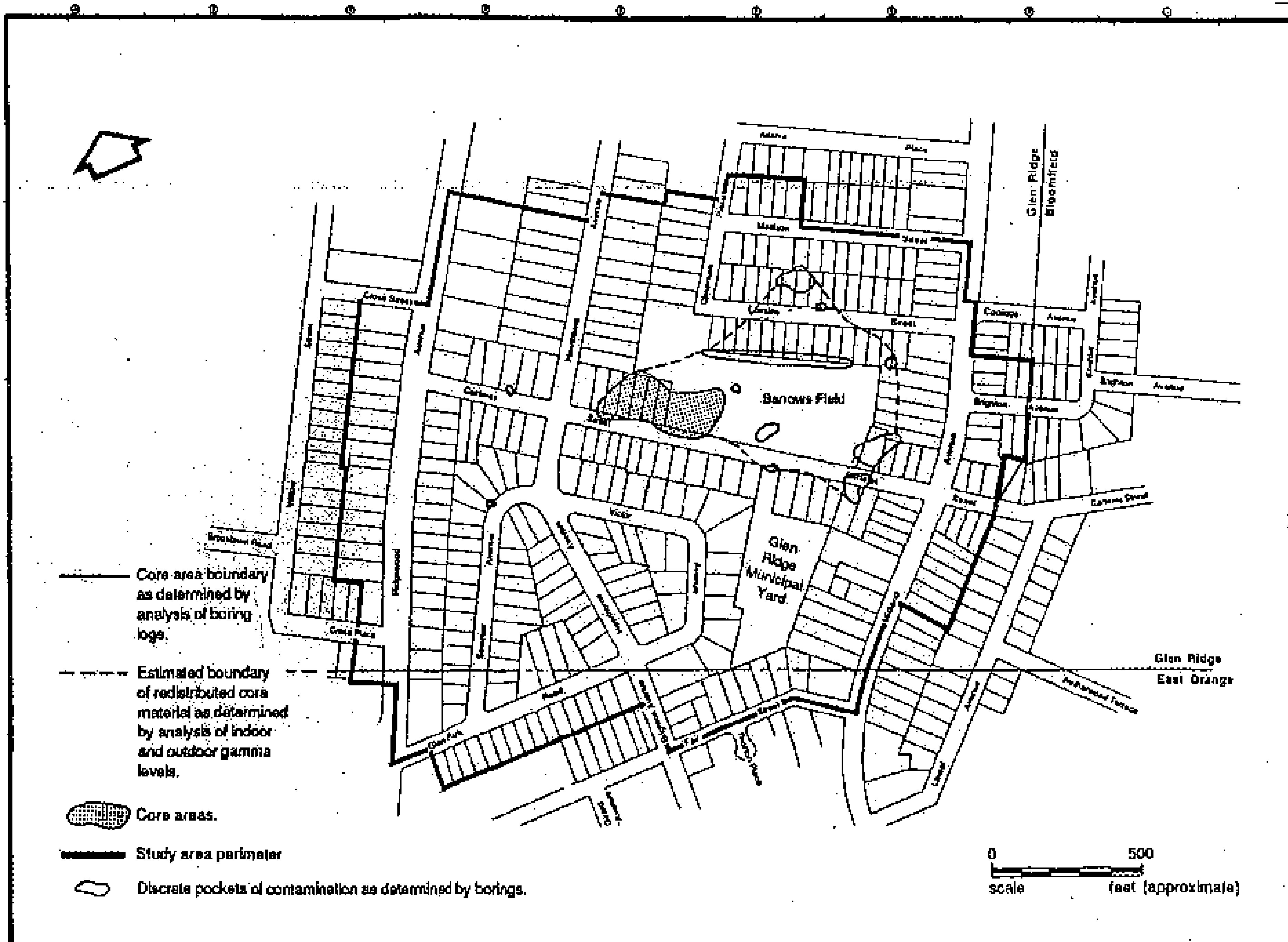


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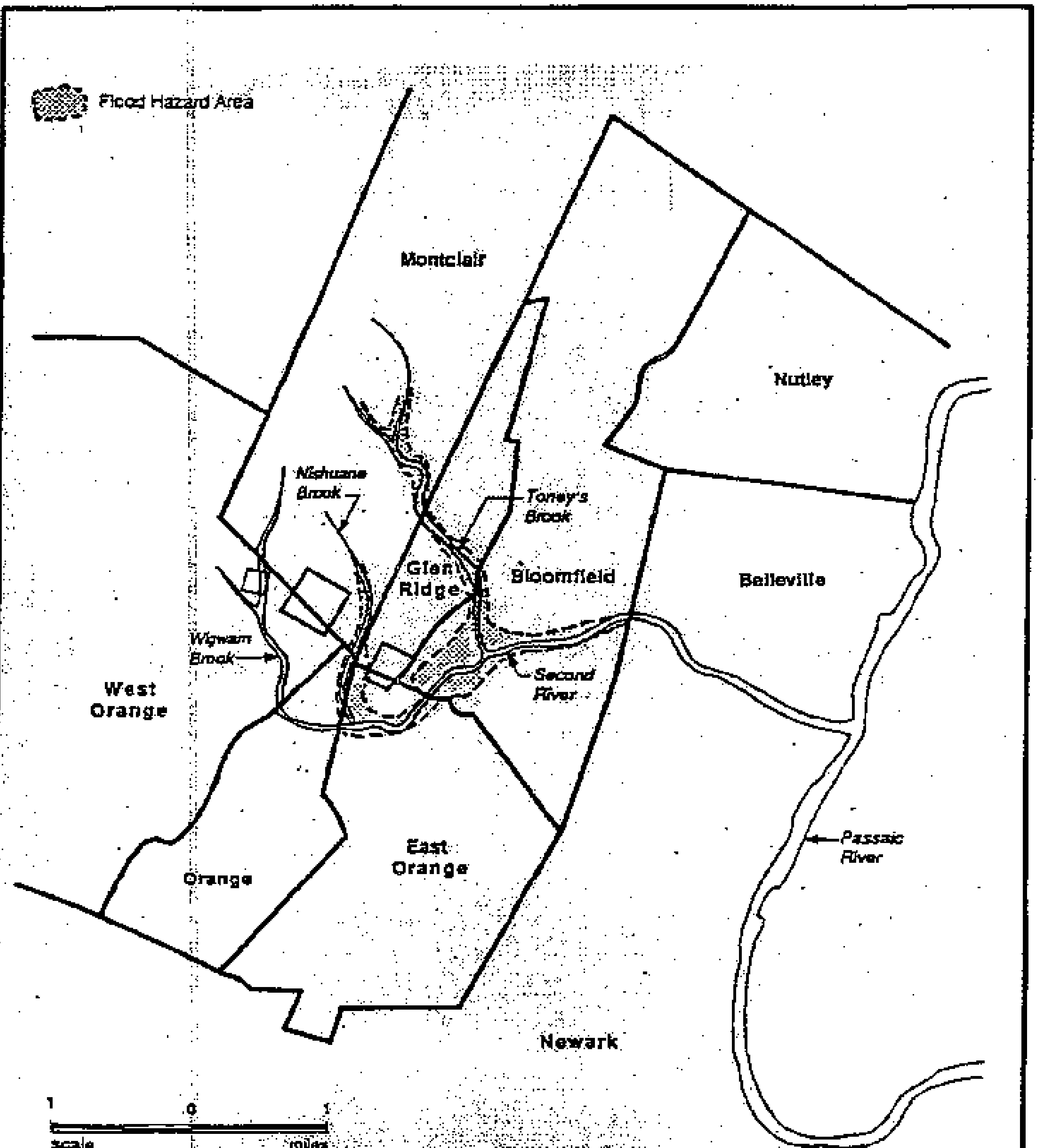
FIGURE 4

GLEN RIDGE STUDY AREA

MONTCLAIR/WEST ORANGE & GLENRIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY



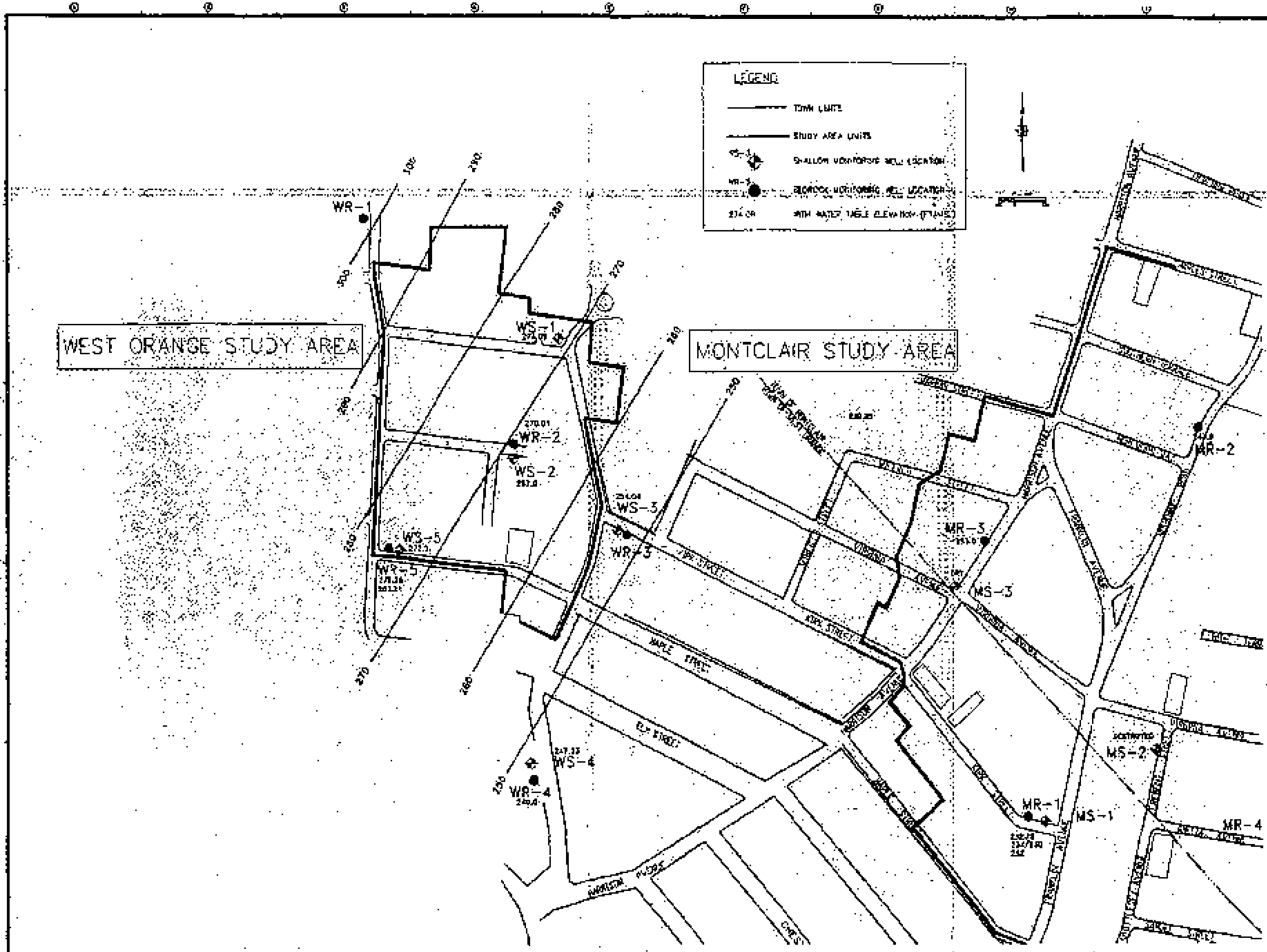
Source: NJDEP Division of Water Resources

CDM

FIGURE 5

SURFACE WATER DRAINAGE

MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY
PROJECT NO.: 3220-036



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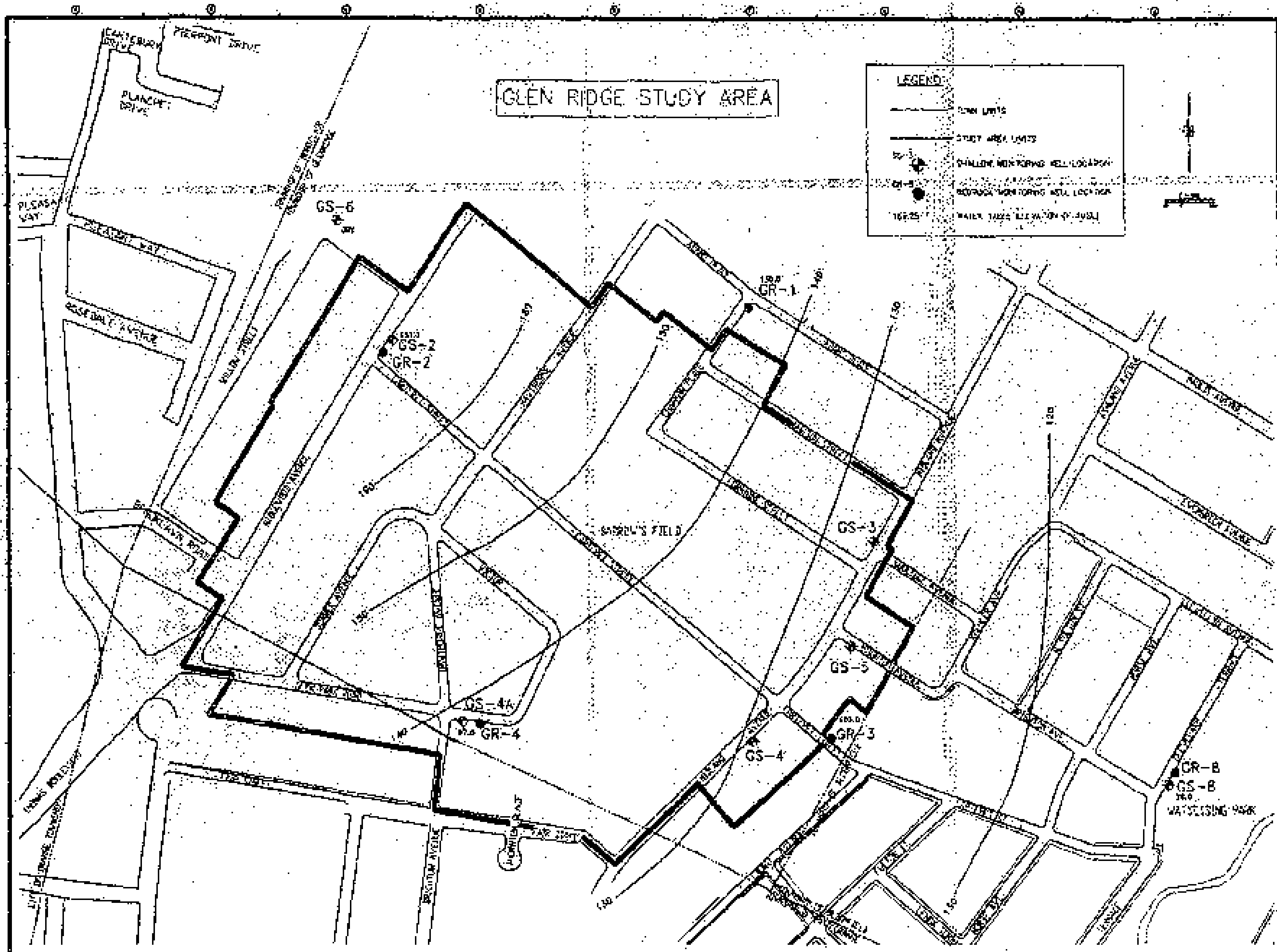
MONTCLAIR/WEST ORANGE & GLENRIDGE RADIUM SITES
ESSEX COUNTY NEW JERSEY

FIGURE 6
WEST ORANGE STUDY AREA WATER TABLE MAP



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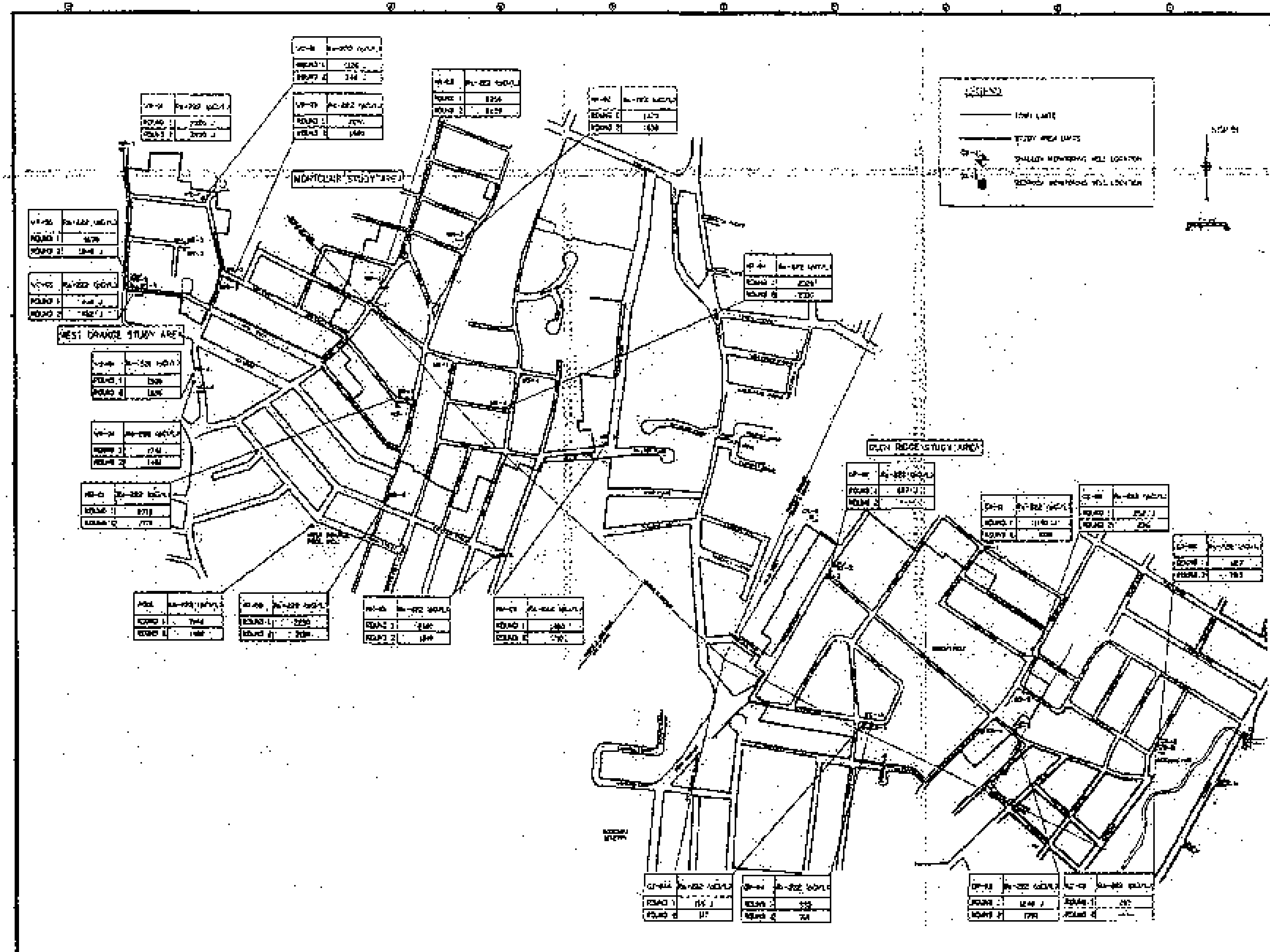
MONTCLAIR/WEST ORANGE & GLENRIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

FIGURE 7
GLEN RIDGE STUDY AREA WATER TABLE MAP



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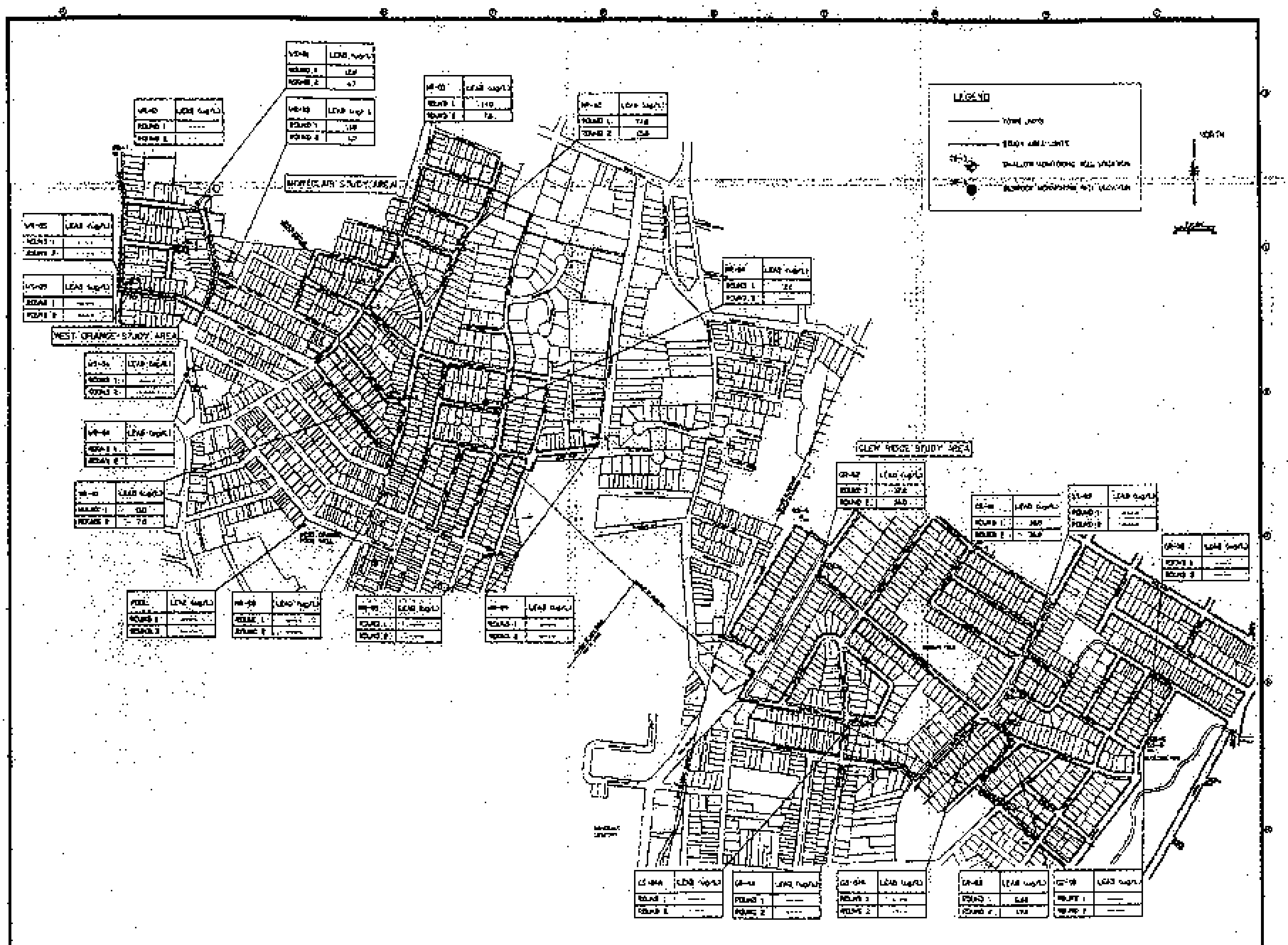
MONTCLAIR/WEST ORANGE & GLENRIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

FIGURE 8
RADON-222 DETECTIONS



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MONTCLAIR/WEST ORANGE & GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

FIGURE 8
LEAD DETECTIONS

APPENDIX II

TABLES

TABLE **DESCRIPTION**

TABLE 1
GROUNDWATER SCREENING CRITERIA
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Analyte	Federal Standards (1)	New Jersey Standards (2)	Analyte	Federal Standards (1)	New Jersey Standards (2)
Aluminum	50-**200**(3)	200	Potassium	NS	NS
Antimony	**6**	20 (4)	Selenium	**50**	50
Arsenic	10	**8** (4)	Silver	**100** (3)	NS
Barium	**2,000**	2,000	Sodium	NS	**50,000**
Beryllium	**4**	20 (4)	Thallium	**2**	10 (4)
Cadmium	5	**4**	Vanadium	NS	NS
Calcium	NS	NS	Zinc	**5,000 (3)**	5,000
Chromium	**100**	100	Cyanide	**200**	200
Cobalt	NS	NS	Gross alpha	**15** pCi/L	NS
Copper	1300	**1,000**	Gross beta	**50** pCi/L(5)	NS
Iron	**300** (3)	300	Radon-222	NS	NS
Lead	15	**10** (4)	Radium-226 Radium-228, combined	**5** pCi/L	NS
Magnesium	NS	NS			
Manganese	**50** (3)	50	Isotopic Uranium	**30** µg/L (6)	NS
Mercury	2	**2**	Isotopic Thorium	NS	NS
Nickel	NS	**100**			

Notes: (1) EPA primary drinking water MCLs (2) Groundwater Class 2A standards (3) Secondary standards (4) Practical Quantitation Limit (5) MCL is 4 mrem/yr; 50 pCi/L is used as an intial screening value; 50 pCi/L is minus the Potassium-40 (K-40) component (6) conversion to pCi/L is 1:1 (40 CFR Parts 9, 141, and 142, Final Rule, page 76713)
bold = selected standard
Units: Inorganic analytes - µg/L; Radionuclides - as indicated
Abbreviations: NS = No Standard; µg/L = micrograms per liter; pCi/L = picoCuries per liter; MCL = Maximum Contaminant Level

TABLE 2
SUMMARY OF ROUND 1 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-230	Th-232
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
Montclair Monitoring Wells										
MR-1	ND	1.87 J	0.629	2.44 J	2,070	0.823	ND	0.202 J	ND	ND
MR-2	ND	ND	1.03	ND	1,470	ND	ND	ND	ND	ND
MR-3	ND	2.84	2.12 J	ND	2,350	ND	ND	ND	ND	ND
MR-4	ND	4.05 J	0.604	ND	2,320	ND	ND	ND	0.223 J	ND
MR-5	ND	2.02 J	ND	ND	2,420	ND	ND	ND	ND	ND
MR-8	ND	3.57 J	0.587	ND	2,280	0.827	ND	ND	ND	ND
MR-9	ND	ND	0.627	ND	1,480	ND	ND	ND	ND	ND
West Orange Monitoring Wells										
WS-1	ND	3.40	ND	ND	1,120 J	ND	ND	ND	0.180 J	ND
WR-1	1.76	ND	ND	ND	2,350 J	2.20	ND	0.799	ND	ND
WR-3	ND	ND	3.37 J	ND	2,050	0.227	ND	ND	ND	ND
WS-4	1.30	2.15 J	ND	ND	1,530	0.903	0.195 J	ND	ND	ND
WR-4	1.83	ND	2.05 J	ND	1,740	0.614	ND	ND	0.481 J	ND

TABLE 2
SUMMARY OF ROUND 1 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-230	Th-232
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
WS-5	ND	ND	ND	ND	440 J	ND	ND	ND	0.256 J	ND
WR-5	ND	ND	ND	ND	1,670	ND	ND	ND	ND	ND
MW-1	ND	4.24	ND	ND	1,870	1.06	ND	ND	ND	ND
MW-2	ND	ND	ND	ND	1,350	ND	ND	ND	ND	ND
Pool	ND	ND	0.852	ND	1,940	2.35	ND	0.693	ND	ND
Glen Ridge Monitoring Wells										
GR-1	ND	ND	0.527	1.97 J	1,190	1.10	ND	0.373 J	ND	ND
GR-2	ND	ND	0.838	ND	687 J	0.722	ND	ND	ND	ND
GR-3	ND	ND	0.857	ND	1,240 J	0.695	ND	0.669 J	ND	ND
GS-4A	ND	ND	U	2.64 J	155 J	0.287	ND	ND	ND	ND
GR-4	1.94	4.21	0.904 J	ND	535	1.83	ND	1.02	ND	ND
GS-5	ND	ND	0.529	ND	258 J	0.793	ND	0.415 J	ND	ND
GS-8	ND	3.09 J	0.512	ND	203	1.12	ND	0.548 J	ND	ND
GR-8	5.96	33.1	1.93 J	ND	48.7	0.355	ND	0.298	ND	ND

Notes: (1) MCL is 4 millirem/year; 50 pCi/L is used as an initial screening value (40 CFR Parts 9, 141, and 142, page 76747); 50

TABLE 2
SUMMARY OF ROUND 1 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

pCi/L is minus the potassium-40 (K-40) component (2) combined Ra-226/Ra-228 (3) uranium standard is 30 µg/L. Conversion to pCi/L is 1:1 ratio (40 CFR Parts 9, 141, and 142, page 76713).

Abbreviations: U-233/234 = uranium-233/234; U-235/236 = uranium-235/236; U-238 = uranium-238; Ra-226 = radium-226; Ra-228 = radium-228; Th-230 = thorium-230; Th-232 = thorium-232; NS = No Standard; ND = Non-Detect; J = estimated value;

Analytical Data Units: picoCuries/Liter (pCi/L)

Full analytical results, including measurement uncertainty and detection limits, are provided in the Remedial Investigation Report.

TABLE 3
SUMMARY OF ROUND 1 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitor-ing Well	Alumin-um (1)	Barium	Calcium	Chrom-ium	Iron (1)	Lead	Magnes-ium	Mangan-ese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
Montclair Monitoring Wells										
MR-1	ND	270	75,000	17	**14,000**	**11**	10,000	**190**	20,000	3,000
MR-2	ND	230	100,000	14	**9,600**	**74**	11,000	**200**	36,000	1,300
MR-3	**320**	1,600	93,000	12	**27,000**	**14**	13,000	**550**	33,000	950
MR-4	**1,300**	270	52,000	21	**1,100**	**11**	5,700	28	21,000	50
MR-5	ND	ND	56,000	ND	ND	ND	5,800	ND	48,000	ND
MR-8	**360**	ND	94,000	ND	**15,000**	ND	12,000	**120**	23,000	100
MR-9	ND	ND	67,000	ND	**3,400**	ND	7,700	29	24,000	ND
West Orange Monitoring Wells										
WS-1	ND	ND	57,000	ND	**ND**	ND	12,000	ND	26,000	ND
WR-1	**260**	330	94,000	15	**15,000**	ND	20,000	**58**	36,000	ND
WR-3	ND	230	64,000	ND	**9,500**	**11**	10,000	**120**	18,000	390
WS-4	**470**	270	64,000	ND	**320**	ND	12,000	ND	27,000	ND
WR-4	ND	220	59,000	ND	**1,600**	ND	11,000	**59**	24,000	ND

TABLE 3
SUMMARY OF ROUND 1 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Aluminum (1)	Barium	Calcium	Chromium	Iron (1)	Lead	Magnesium	Manganese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
WS-5	**240**	ND	11,000	15	**330**	ND	ND	ND	11,000	25
WR-5	ND	ND	43,000	ND	**4,500**	ND	8,200	**100**	25,000	ND
MW-1	**760**	250	67,000	14	**640**	ND	12,000	**61**	15,000	ND
MW-2	ND	ND	48,000	ND	120	ND	10,000	**150**	40,000	ND
Pool (2)	ND	290	89,000	ND	ND	ND	18,000	ND	25,000	ND
Glen Ridge Monitoring Wells										
GR-1	ND	220	73,000	ND	**1,400**	**16**	14,000	ND	39,000	340
GR-2	ND	ND	85,000	ND	**3,100**	ND	12,000	24	20,000	420
GR-3	ND	260	120,000	ND	ND	6.6	20,000	ND	31,000	330
GS-4A	ND	ND	65,000	ND	ND	ND	14,000	ND	**65,000**	ND
GR-4	ND	ND	79,000	ND	**340**	ND	23,000	ND	17,000	680
GS-5	ND	220	120,000	ND	280	ND	18,000	ND	**71,000**	ND
GS-8	**400**	ND	100,000	ND	**380**	ND	19,000	ND	**64,000**	ND
GR-8	ND	ND	98,000	ND	**4,800**	ND	21,000	**240** (1)	**60,000**	ND

TABLE 3
SUMMARY OF ROUND 1 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Notes: (1) Secondary regulatory standard; (2) The pool well also had a detection of copper at 31 µg/L

Abbreviations: ND = Non-Detect

Units: micrograms/Liter (µg/L)

bold: exceeds regulatory criteria

Full analytical results, including detection limits, are provided in the Remedial Investigation Report.

TABLE 4
SUMMARY OF ROUND 2 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-228	Th-230
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
Montclair Monitoring Wells										
MR-1	ND	2.34	1.18 J	ND	1,710	0.452	ND	ND	0.615	ND
MR-2	3.15 J	2.11	ND	ND	1,650	ND	ND	ND	ND	ND
MR-3	ND	ND	ND	ND	2,220	ND	ND	ND	ND	0.198 J
MR-4	ND	2.28	1.04 J	ND	2,300	ND	ND	ND	ND	ND
MR-5	ND	ND	0.987 J	ND	1,840	ND	ND	ND	ND	ND
MR-8	2.42	15.8	ND	ND	2,120	0.638	ND	0.314	ND	ND
MR-9	ND	3.74	ND	ND	1,710	ND	ND	ND	ND	ND
West Orange Monitoring Wells										
WS-1	ND	3.07	1.22 J	ND	740 J	ND	ND	ND	ND	ND
WR-1	ND	ND	0.981 J	ND	2,450 J	1.93	ND	0.626	ND	ND
WR-3	ND	2.25	0.989 J	ND	1,520	ND	ND	ND	ND	0.520
WS-4	4.34	3.25	1.01 J	ND	1,690	0.330	ND	ND	ND	ND
WR-4	ND	ND	1.03 J	ND	1,460	ND	ND	ND	ND	0.222

TABLE 4
SUMMARY OF ROUND 2 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-228	Th-230
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
WS-5	ND	ND	0.953 J	ND	482 J	ND	ND	ND	ND	ND
WR-5	ND	ND	1.58 J	ND	1,840 J	0.171	ND	ND	ND	ND
MW-1	2.54	2.59	0.904 J	ND	1,970	0.952	ND	0.242	ND	ND
MW-2	ND	ND	1.05 J	ND	1,440	ND	ND	ND	0.163	ND
Pool	ND	3.02	ND	ND	1,480	ND	ND	ND	ND	ND
Glen Ridge Monitoring Wells										
GR-1	ND	9.08	ND	ND	1,080	1.13	ND	0.551	ND	ND
GR-2	ND	ND	ND	ND	ND	0.344	ND	ND	ND	ND
GR-3	ND	4.00 J	ND	ND	1,090	1.08	0.198	ND	ND	ND
GS-4A	ND	8.49	ND	ND	117	ND	ND	ND	ND	ND
GR-4	2.84 J	2.10	ND	ND	515	1.89	ND	1.06 J	ND	ND
GS-5	ND	2.80	ND	ND	236	0.820	ND	ND	ND	ND
GS-8	ND	4.12	0.637 J	ND	ND	1.11	0.234	0.516	ND	ND
GR-8	ND	3.00	ND	ND	78.5	0.440	ND	ND	ND	ND

Notes: (1) MCL is 4 millirem/year; 50 pCi/L is used as an initial screening value (40 CFR Parts 9, 141, and 142, page 76747); 50

pCi/L is minus the potassium-40 (K-40) component (2) combined Ra-226/Ra-228 (3) uranium standard is 30 µg/L. Conversion to pCi/L is 1:1 ratio (40 CFR Parts 9, 141, and 142, page 76713).

Abbreviations: U-233/234 = uranium-233/234; U-235/236 = uranium-235/236; U-238 = uranium-238; Ra-226 = radium-226; Ra-228 = radium-228; Th-230 = thorium-230; Th-232 = thorium-232; NS = No Standard; ND = Non-Detect; J = estimated value;

Analytical Data Units: picoCuries/Liter (pCi/L)

Full analytical results, including measurement uncertainty and detection limits, are provided in the Remedial Investigation Report.

TABLE 5
SUMMARY OF ROUND 2 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Aluminum (1)	Barium	Calcium	Chromium	Iron (1)	Lead	Magnesium	Manganese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
Montclair Monitoring Wells										
MR-1	ND	280	69,000	ND	**6,500**	7.0	9,700	**370**	19,000	1,100
MR-2	ND	ND	88,000	ND	**2,000**	**15**	10,000	**110**	34,000	240
MR-3	ND	820	73,000	21	**7,700**	7.6	11,000	**170**	31,000	810
MR-4	ND	270	52,000	ND	ND	ND	5,700	ND	22,000	ND
MR-5	ND	ND	62,000	ND	ND	ND	6,400	ND	**56,000**	ND
MR-8	ND	ND	87,000	ND	**600**	ND	12,000	ND	24,000	ND
MR-9	ND	ND	65,000	ND	**5,300**	ND	7,500	19	23,000	ND
West Orange Monitoring Wells										
WS-1	ND	ND	52,000	ND	120	ND	11,000	ND	24,000	ND
WR-1	ND	310	87,000	ND	**1,900**	ND	19,000	ND	35,000	ND
WR-3	ND	250	56,000	ND	**5,100**	4.7	9,400	38	17,000	190
WS-4	ND	280	64,000	ND	ND	ND	12,000	ND	33,000	ND
WR-4	ND	ND	49,000	ND	**8,800**	ND	8,100	**69**	31,000	ND

TABLE 5
SUMMARY OF ROUND 2 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Aluminum (1)	Barium	Calcium	Chromium	Iron (1)	Lead	Magnesium	Manganese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
WS-5	ND	ND	23,000	ND	ND	ND	6,600	ND	25,000	ND
WR-5	ND	ND	41,000	ND	**2,200**	ND	8,000	23	27,000	ND
MW-1	ND	220	62,000	43	**370**	ND	11,000	ND	16,000	ND
MW-2	ND	ND	47,000	ND	ND	ND	11,000	**230**	**54,000**	ND
Pool (2)	ND	ND	79,000	ND	ND	ND	11,000	ND	43,000	ND
Glen Ridge Monitoring Wells										
GR-1	ND	ND	71,000	ND	**1,300**	**36**	13,000	ND	34,000	650
GR-2	ND	240	39,000	ND	**2,100**	**36**	7,400	**75**	21,000	500
GR-3	**270**	270	110,000	ND	**340**	**19**	18,000	**54**	30,000	910
GS-4A	ND	ND	66,000	ND	ND	ND	14,000	ND	**65,000**	ND
GR-4	ND	300	75,000	ND	200	ND	23,000	ND	17,000	610
GS-5	ND	220	120,000	ND	ND	ND	18,000	ND	**74,000**	ND
GS-8	ND	ND	91,000	ND	ND	ND	17,000	17	**58,000**	ND
GR-8	ND	ND	98,000	ND	**3,800**	ND	21,000	**110**	**62,000**	ND

Notes: (1) Secondary regulatory standard; (2) The pool well also had a detection of copper at 91 µg/L

Abbreviations: ND = Non-Detect

Units: micrograms/Liter (µg/L)

bold: exceeds regulatory criteria

Full analytical results, including detection limits, are provided in Remedial Investigation Report.

TABLE 1
GROUNDWATER SCREENING CRITERIA
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Analyte	Federal Standards (1)	New Jersey Standards (2)	Analyte	Federal Standards (1)	New Jersey Standards (2)
Aluminum	50-**200**(3)	200	Potassium	NS	NS
Antimony	**6**	20 (4)	Selenium	**50**	50
Arsenic	10	**8** (4)	Silver	**100** (3)	NS
Barium	**2,000**	2,000	Sodium	NS	**50,000**
Beryllium	**4**	20 (4)	Thallium	**2**	10 (4)
Cadmium	5	**4**	Vanadium	NS	NS
Calcium	NS	NS	Zinc	**5,000 (3)**	5,000
Chromium	**100**	100	Cyanide	**200**	200
Cobalt	NS	NS	Gross alpha	**15** pCi/L	NS
Copper	1300	**1,000**	Gross beta	**50** pCi/L(5)	NS
Iron	**300** (3)	300	Radon-222	NS	NS
Lead	15	**10** (4)	Radium-226 Radium-228, combined	**5** pCi/L	NS
Magnesium	NS	NS			
Manganese	**50** (3)	50	Isotopic Uranium	**30** µg/L (6)	NS
Mercury	2	**2**	Isotopic Thorium	NS	NS
Nickel	NS	**100**			

Notes: (1) EPA primary drinking water MCLs (2) Groundwater Class 2A standards (3) Secondary standards (4) Practical Quantitation Limit (5) MCL is 4 mrem/yr; 50 pCi/L is used as an intial screening value; 50 pCi/L is minus the Potassium-40 (K-40) component (6) conversion to pCi/L is 1:1 (40 CFR Parts 9, 141, and 142, Final Rule, page 76713)

bold = selected standard

Units: Inorganic analytes - µg/L; Radionuclides - as indicated

Abbreviations: NS = No Standard; µg/L = micrograms per liter; pCi/L = picoCuries per liter; MCL = Maximum Contaminant Level

TABLE 2
SUMMARY OF ROUND 1 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-230	Th-232
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
Montclair Monitoring Wells										
MR-1	ND	1.87 J	0.629	2.44 J	2,070	0.823	ND	0.202 J	ND	ND
MR-2	ND	ND	1.03	ND	1,470	ND	ND	ND	ND	ND
MR-3	ND	2.84	2.12 J	ND	2,350	ND	ND	ND	ND	ND
MR-4	ND	4.05 J	0.604	ND	2,320	ND	ND	ND	0.223 J	ND
MR-5	ND	2.02 J	ND	ND	2,420	ND	ND	ND	ND	ND
MR-8	ND	3.57 J	0.587	ND	2,280	0.827	ND	ND	ND	ND
MR-9	ND	ND	0.627	ND	1,480	ND	ND	ND	ND	ND
West Orange Monitoring Wells										
WS-1	ND	3.40	ND	ND	1,120 J	ND	ND	ND	0.180 J	ND
WR-1	1.76	ND	ND	ND	2,350 J	2.20	ND	0.799	ND	ND
WR-3	ND	ND	3.37 J	ND	2,050	0.227	ND	ND	ND	ND
WS-4	1.30	2.15 J	ND	ND	1,530	0.903	0.195 J	ND	ND	ND
WR-4	1.83	ND	2.05 J	ND	1,740	0.614	ND	ND	0.481 J	ND

TABLE 2
SUMMARY OF ROUND 1 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-230	Th-232
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
WS-5	ND	ND	ND	ND	440 J	ND	ND	ND	0.256 J	ND
WR-5	ND	ND	ND	ND	1,670	ND	ND	ND	ND	ND
MW-1	ND	4.24	ND	ND	1,870	1.06	ND	ND	ND	ND
MW-2	ND	ND	ND	ND	1,350	ND	ND	ND	ND	ND
Pool	ND	ND	0.852	ND	1,940	2.35	ND	0.693	ND	ND
Glen Ridge Monitoring Wells										
GR-1	ND	ND	0.527	1.97 J	1,190	1.10	ND	0.373 J	ND	ND
GR-2	ND	ND	0.838	ND	687 J	0.722	ND	ND	ND	ND
GR-3	ND	ND	0.857	ND	1,240 J	0.695	ND	0.669 J	ND	ND
GS-4A	ND	ND	U	2.64 J	155 J	0.287	ND	ND	ND	ND
GR-4	1.94	4.21	0.904 J	ND	535	1.83	ND	1.02	ND	ND
GS-5	ND	ND	0.529	ND	258 J	0.793	ND	0.415 J	ND	ND
GS-8	ND	3.09 J	0.512	ND	203	1.12	ND	0.548 J	ND	ND
GR-8	5.96	33.1	1.93 J	ND	48.7	0.355	ND	0.298	ND	ND

Notes: (1) MCL is 4 millirem/year; 50 pCi/L is used as an initial screening value (40 CFR Parts 9, 141, and 142, page 76747); 50

TABLE 2
SUMMARY OF ROUND 1 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

pCi/L is minus the potassium-40 (K-40) component (2) combined Ra-226/Ra-228 (3) uranium standard is 30 μg/L. Conversion to pCi/L is 1:1 ratio (40 CFR Parts 9, 141, and 142, page 76713).

Abbreviations: U-233/234 = uranium-233/234; U-235/236 = uranium-235/236; U-238 = uranium-238; Ra-226 = radium-226; Ra-228 = radium-228; Th-230 = thorium-230; Th-232 = thorium-232; NS = No Standard; ND = Non-Detect; J = estimated value;

Analytical Data Units: picoCuries/Liter (pCi/L)

Full analytical results, including measurement uncertainty and detection limits, are provided in the Remedial Investigation Report.

TABLE 3
SUMMARY OF ROUND 1 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Aluminum (1)	Barium	Calcium	Chromium	Iron (1)	Lead	Magnesium	Manganese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
Montclair Monitoring Wells										
MR-1	ND	270	75,000	17	**14,000**	**11**	10,000	**190**	20,000	3,000
MR-2	ND	230	100,000	14	**9,600**	**74**	11,000	**200**	36,000	1,300
MR-3	**320**	1,600	93,000	12	**27,000**	**14**	13,000	**550**	33,000	950
MR-4	**1,300**	270	52,000	21	**1,100**	**11**	5,700	28	21,000	50
MR-5	ND	ND	56,000	ND	ND	ND	5,800	ND	48,000	ND
MR-8	**360**	ND	94,000	ND	**15,000**	ND	12,000	**120**	23,000	100
MR-9	ND	ND	67,000	ND	**3,400**	ND	7,700	29	24,000	ND
West Orange Monitoring Wells										
WS-1	ND	ND	57,000	ND	**ND**	ND	12,000	ND	26,000	ND
WR-1	**260**	330	94,000	15	**15,000**	ND	20,000	**58**	36,000	ND
WR-3	ND	230	64,000	ND	**9,500**	**11**	10,000	**120**	18,000	390
WS-4	**470**	270	64,000	ND	**320**	ND	12,000	ND	27,000	ND
WR-4	ND	220	59,000	ND	**1,600**	ND	11,000	**59**	24,000	ND

TABLE 3
SUMMARY OF ROUND 1 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Aluminum (1)	Barium	Calcium	Chromium	Iron (1)	Lead	Magnesium	Manganese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
WS-5	**240**	ND	11,000	15	**330**	ND	ND	ND	11,000	25
WR-5	ND	ND	43,000	ND	**4,500**	ND	8,200	**100**	25,000	ND
MW-1	**760**	250	67,000	14	**640**	ND	12,000	**61**	15,000	ND
MW-2	ND	ND	48,000	ND	120	ND	10,000	**150**	40,000	ND
Pool (2)	ND	290	89,000	ND	ND	ND	18,000	ND	25,000	ND
Glen Ridge Monitoring Wells										
GR-1	ND	220	73,000	ND	**1,400**	**16**	14,000	ND	39,000	340
GR-2	ND	ND	85,000	ND	**3,100**	ND	12,000	24	20,000	420
GR-3	ND	260	120,000	ND	ND	6.6	20,000	ND	31,000	330
GS-4A	ND	ND	65,000	ND	ND	ND	14,000	ND	**65,000**	ND
GR-4	ND	ND	79,000	ND	**340**	ND	23,000	ND	17,000	680
GS-5	ND	220	120,000	ND	280	ND	18,000	ND	**71,000**	ND
GS-8	**400**	ND	100,000	ND	**380**	ND	19,000	ND	**64,000**	ND
GR-8	ND	ND	98,000	ND	**4,800**	ND	21,000	**240** (1)	**60,000**	ND

TABLE 3
SUMMARY OF ROUND 1 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Notes: (1) Secondary regulatory standard; (2) The pool well also had a detection of copper at 31 µg/L

Abbreviations: ND = Non-Detect

Units: micrograms/Liter (µg/L)

bold: exceeds regulatory criteria

Full analytical results, including detection limits, are provided in the Remedial Investigation Report.

TABLE 4
SUMMARY OF ROUND 2 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-228	Th-230
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
Montclair Monitoring Wells										
MR-1	ND	2.34	1.18 J	ND	1,710	0.452	ND	ND	0.615	ND
MR-2	3.15 J	2.11	ND	ND	1,650	ND	ND	ND	ND	ND
MR-3	ND	ND	ND	ND	2,220	ND	ND	ND	ND	0.198 J
MR-4	ND	2.28	1.04 J	ND	2,300	ND	ND	ND	ND	ND
MR-5	ND	ND	0.987 J	ND	1,840	ND	ND	ND	ND	ND
MR-8	2.42	15.8	ND	ND	2,120	0.638	ND	0.314	ND	ND
MR-9	ND	3.74	ND	ND	1,710	ND	ND	ND	ND	ND
West Orange Monitoring Wells										
WS-1	ND	3.07	1.22 J	ND	740 J	ND	ND	ND	ND	ND
WR-1	ND	ND	0.981 J	ND	2,450 J	1.93	ND	0.626	ND	ND
WR-3	ND	2.25	0.989 J	ND	1,520	ND	ND	ND	ND	0.520
WS-4	4.34	3.25	1.01 J	ND	1,690	0.330	ND	ND	ND	ND
WR-4	ND	ND	1.03 J	ND	1,460	ND	ND	ND	ND	0.222

TABLE 4
SUMMARY OF ROUND 2 RADIONUCLIDE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitoring Well	Gross Alpha	Gross Beta	Ra-226	Ra-228	Radon-222	U-233/234	U-235/236	U-238	Th-228	Th-230
Screening Criteria	**15**	**50 (1)**	**5 (2)**	**5 (2)**	**NS**	**30 (3)**	**30 (3)**	**30 (3)**	**NS**	**NS**
WS-5	ND	ND	0.953 J	ND	482 J	ND	ND	ND	ND	ND
WR-5	ND	ND	1.58 J	ND	1,840 J	0.171	ND	ND	ND	ND
MW-1	2.54	2.59	0.904 J	ND	1,970	0.952	ND	0.242	ND	ND
MW-2	ND	ND	1.05 J	ND	1,440	ND	ND	ND	0.163	ND
Pool	ND	3.02	ND	ND	1,480	ND	ND	ND	ND	ND
Glen Ridge Monitoring Wells										
GR-1	ND	9.08	ND	ND	1,080	1.13	ND	0.551	ND	ND
GR-2	ND	ND	ND	ND	ND	0.344	ND	ND	ND	ND
GR-3	ND	4.00 J	ND	ND	1,090	1.08	0.198	ND	ND	ND
GS-4A	ND	8.49	ND	ND	117	ND	ND	ND	ND	ND
GR-4	2.84 J	2.10	ND	ND	515	1.89	ND	1.06 J	ND	ND
GS-5	ND	2.80	ND	ND	236	0.820	ND	ND	ND	ND
GS-8	ND	4.12	0.637 J	ND	ND	1.11	0.234	0.516	ND	ND
GR-8	ND	3.00	ND	ND	78.5	0.440	ND	ND	ND	ND

Notes: (1) MCL is 4 millirem/year; 50 pCi/L is used as an initial screening value (40 CFR Parts 9, 141, and 142, page 76747); 50

pCi/L is minus the potassium-40 (K-40) component (2) combined Ra-226/Ra-228 (3) uranium standard is 30 μg/L. Conversion to pCi/L is 1:1 ratio (40 CFR Parts 9, 141, and 142, page 76713).

Abbreviations: U-233/234 = uranium-233/234; U-235/236 = uranium-235/236; U-238 = uranium-238; Ra-226 = radium-226; Ra-228 = radium-228; Th-230 = thorium-230; Th-232 = thorium-232; NS = No Standard; ND = Non-Detect; J = estimated value;

Analytical Data Units: picoCuries/Liter (pCi/L)

Full analytical results, including measurement uncertainty and detection limits, are provided in the Remedial Investigation Report.

TABLE 5
SUMMARY OF ROUND 2 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitor-ing Well	Alumin-um (1)	Barium	Calcium	Chrom-ium	Iron (1)	Lead	Magnes-ium	Mangan-ese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
Montclair Monitoring Wells										
MR-1	ND	280	69,000	ND	**6,500**	7.0	9,700	**370**	19,000	1,100
MR-2	ND	ND	88,000	ND	**2,000**	**15**	10,000	**110**	34,000	240
MR-3	ND	820	73,000	21	**7,700**	7.6	11,000	**170**	31,000	810
MR-4	ND	270	52,000	ND	ND	ND	5,700	ND	22,000	ND
MR-5	ND	ND	62,000	ND	ND	ND	6,400	ND	**56,000**	ND
MR-8	ND	ND	87,000	ND	**600**	ND	12,000	ND	24,000	ND
MR-9	ND	ND	65,000	ND	**5,300**	ND	7,500	19	23,000	ND
West Orange Monitoring Wells										
WS-1	ND	ND	52,000	ND	120	ND	11,000	ND	24,000	ND
WR-1	ND	310	87,000	ND	**1,900**	ND	19,000	ND	35,000	ND
WR-3	ND	250	56,000	ND	**5,100**	4.7	9,400	38	17,000	190
WS-4	ND	280	64,000	ND	ND	ND	12,000	ND	33,000	ND
WR-4	ND	ND	49,000	ND	**8,800**	ND	8,100	**69**	31,000	ND

TABLE 5
SUMMARY OF ROUND 2 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Monitor-ing Well	Alumin-um (1)	Barium	Calcium	Chrom-ium	Iron (1)	Lead	Magnes-ium	Mangan-ese (1)	Sodium	Zinc (1)
Screening Criteria	**200**	**2,000**	**NS**	**100**	**300**	**10**	**NS**	**50**	**50,000**	**5,000**
WS-5	ND	ND	23,000	ND	ND	ND	6,600	ND	25,000	ND
WR-5	ND	ND	41,000	ND	**2,200**	ND	8,000	23	27,000	ND
MW-1	ND	220	62,000	43	**370**	ND	11,000	ND	16,000	ND
MW-2	ND	ND	47,000	ND	ND	ND	11,000	**230**	**54,000**	ND
Pool (2)	ND	ND	79,000	ND	ND	ND	11,000	ND	43,000	ND
Glen Ridge Monitoring Wells										
GR-1	ND	ND	71,000	ND	**1,300**	**36**	13,000	ND	34,000	650
GR-2	ND	240	39,000	ND	**2,100**	**36**	7,400	**75**	21,000	500
GR-3	**270**	270	110,000	ND	**340**	**19**	18,000	**54**	30,000	910
GS-4A	ND	ND	66,000	ND	ND	ND	14,000	ND	**65,000**	ND
GR-4	ND	300	75,000	ND	200	ND	23,000	ND	17,000	610
GS-5	ND	220	120,000	ND	ND	ND	18,000	ND	**74,000**	ND
GS-8	ND	ND	91,000	ND	ND	ND	17,000	17	**58,000**	ND
GR-8	ND	ND	98,000	ND	**3,800**	ND	21,000	**110**	**62,000**	ND

TABLE 5
SUMMARY OF ROUND 2 INORGANIC ANALYTE RESULTS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Notes: (1) Secondary regulatory standard; (2) The pool well also had a detection of copper at 91 µg/L

Abbreviations: ND = Non-Detect

Units: micrograms/Liter (µg/L)

bold: exceeds regulatory criteria

Full analytical results, including detection limits, are provided in Remedial Investigation Report.

TABLE 6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
MONTCLAIR/WEST ORANGE & GLEN RIDGE RADIUM SITES - ESSEX COUNTY, NJ

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)	Potential ARAR/TBC Value (1)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection
Tap Water		METALS													
	7429-90-5	Aluminum	240	1300	ug/l	MR-04-R1	10 / 55	200 - 200	1.3E+03	NA	4E+03 NC	200	NJGW/EPAMCL	NO	BSL
	7440-39-3	Barium	220	1600	ug/l	MR-03-R1	28 / 55	200 - 200	1.6E+03	NA	3E+02 NC	2.00E+03	NJGW/EPAMCL	YES	ASL
	7440-70-2	Calcium	11000	120000	ug/l	GR-03-R1	55 / 55	NA - NA	1.2E+05	NA	NA NA	NA	NA	NO	NUT
	7440-47-3	Chromium	12	43	ug/l	MW-01-R2	9 / 55	10 - 10	4.3E+01	NA	1E+01 NC	1.00E+02	NJGW/EPAMCL	YES	ASL
	7440-50-8	Copper	31	91	ug/l	POOL-R2	2 / 55	25 - 25	9.1E+01	NA	1E+02 CA	1.00E+03	NJGW	NO	IFD
	7439-89-6	Iron	120	27000	ug/l	MR-03-R1	39 / 55	100 - 100	2.7E+04	NA	1E+03 NC	3.00E+02	NJGW/EPAMCL	YES	ASL
	7439-92-1	Lead	4.7	74	ug/l	MR-02-R1	17 / 55	3 - 3	7.4E+01	NA	NA NA	1.00E+01	NJGW	YES	ASL2
	7439-95-4	Magnesium	5700	23000	ug/l	GR-04-R1	54 / 55	5000 - 5000	2.3E+04	NA	NA NA	NA	NA	NO	NUT
	7439-96-5	Manganese	17	550	ug/l	MR-03-R1	31 / 55	15 - 15	5.5E+02	NA	9E+01 NC	5.00E+01	NJGW	YES	ASL
	7440-23-5	Sodium	11000	74000	ug/l	GS-05-R2	55 / 55	NA - NA	7.4E+04	NA	NA NA	5.00E+04	NJGW	NO	NUT
	7440-66-6	Zinc	25	3000	ug/l	MR-01-R1	21 / 55	20 - 20	3.0E+03	NA	1E+03 NC	5.00E+03	NJGW	YES	ASL
		RADIONUCLIDES													
	12587-46-1	Gross-Alpha	1.3	5.96	pCi/l	GR-08-R1	10 / 54	1.58 - 3.03	6.0E+00	NA	NA NA	1.50E+01	EPAMCL	YES	TOX
	12587-47-2	Gross-Beta	1.87 J	33.1	pCi/l	GR-08-R1	29 / 54	1.48 - 3.21	3.3E+01	NA	NA NA	5.00E+01	EPAMCL	YES	TOX
	13982-63-3	Radium-226	0.512	3.37 J	pCi/l	WR-03-R1	30 / 54	0.286 - 5.14	3.4E+00	NA	8.16E-04 CA	5.0E+00 (4)	EPAMCL	YES	TOX
	15262-20-1	Radium-228	1.97 J	2.64 J	pCi/l	GS-4A-R1	5 / 54	1.13 - 2.21	2.6E+00	NA	4.58E-02 CA	5.0E+00 (4)	EPAMCL	YES	TOX
	14859-67-7	Radon-222	48.7	2450 J	pCi/l	WR-01-R2	51 / 54	40.3 - 92.5	2.5E+03	NA	1.26E+00 CA	NA	NA	YES	TOX
	14274-82-9	Thorium-228	0.134	0.615	pCi/l	MR-01-R2	3 / 54	0.139 - 0.242	6.2E-01	NA	1.59E-01 CA	NA	NA	YES	TOX
	125894-48-6	Thorium-230	0.0822	0.52	pCi/l	WR-03-R2	9 / 54	0.02815 - 0.606	5.2E-01	NA	5.23E-01 CA	NA	NA	YES	TOX
	13966-29-5	Uranium-233 and Ur-234	0.171	2.35	pCi/l	POOL-R1	32 / 54	0.0951 - 0.302	2.4E+00	NA	6.63E-01 CA	2.0E+01 (5)	EPAMCL	YES	TOX
	13982-70-2	Uranium-235 and Ur-236	0.195	0.234	pCi/l	GS-08-R2	3 / 54	0.0843 - 0.2	2.3E-01	NA	6.63E-01 CA	2.0E+01 (5)	EPAMCL	YES	TOX
	7440-61-1	Uranium-238	0.0905	1.06 J	pCi/l	GR-04-R2	18 / 54	0.0523 - 0.793	1.1E+00	NA	5.47E-01 CA	2.0E+01 (5)	EPAMCL	YES	TOX

(1) NJGW = New Jersey Ground Water Standard.
EPAMCL = EPA. 1999. National Primary Drinking Water Standards. EPA 810-F-94-001. December.

(2) NA - Background data are not available for this Site.

(3) EPA Region 9 Preliminary Remediation Goals (PRGs) for tap water. Nov. 2000. http://www.epa.gov/region09/waste/sfund/prg/
EPA OSWER Radionuclide Preliminary Remediation Goals (PRGs). May 29, 2002. http://epa-prgs.ornl.gov/radionuclides

(4) The MCL of 5 pCi/l applies to the combined total of radium-226 and radium-228. None of the individual monitoring well samples had a combined Ra-226 and Ra-228 concentration that exceeded this standard. See data in Appendix A.

(5) An MCL of 30 ug/l applies to uranium. The uranium MCL was converted to units of pCi/L using a conversion factor of 0.67 pCi/ug.

Rationale Codes:
Selection Reason: ASL = Above Screening Levels
ASL2 = Above ARAR/TBC in absence of screening level
TOX = Toxicity: chemical is an A carcinogen
Deletion Reason: BSL = Below Screening Level
IFD = Infrequent Detection (chemical detected in less than 5 percent of samples)
NUT = Essential Nutrient

Definitions: NA = Not Available
CA = Based on carcinogenic effects (cancer risk = 10-6)
NC = Based on noncarcinogenic effect (hazard quotient = 0.1)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
COPC = Chemical of Potential Concern
J = Estimated Value

TABLE 7
SELECTION OF EXPOSURE PATHWAYS
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Groundwater	Groundwater	Tap Water	Resident	Adult	Ingestion	None	Current supply wells do not draw on contaminated portion of aquifer. No current complete exposure pathways.
						Dermal	None	Current supply wells do not draw on contaminated portion of aquifer. No current complete exposure pathways.
					Child (0-6 yrs)	Ingestion	None	Current supply wells do not draw on contaminated portion of aquifer. No current complete exposure pathways.
						Dermal	None	Current supply wells do not draw on contaminated portion of aquifer. No current complete exposure pathways.
				Site Worker	Adult	Ingestion	None	Current supply wells do not draw on contaminated portion of aquifer. No current complete exposure pathways.
		Air	Water Vapors at Showerhead	Resident	Adult	Inhalation	None	Current supply wells do not draw on contaminated portion of aquifer. No current complete exposure pathways.
					Child (0-6 yrs)	Inhalation	None	Current supply wells do not draw on contaminated portion of aquifer. No current complete exposure pathways.
Future	Groundwater	Groundwater	Tap Water	Resident	Adult	Ingestion	Quant	Future supply wells could draw on contaminated aquifer, and residents may use groundwater as drinking water.*
						Dermal	Quant	Futute supply wells could draw on contaminated aquifer, and residents may be exposed to groundwater while showering.*
					Child (0-6 yrs)	Ingestion	Quant	Future supply wells could draw on contaminated aquifer, and residents may use groundwater as drinking water.*
						Dermal	Quant	Future supply wells could draw on contaminated aquifer, and residents may be exposed to groundwater while showering.*
				Site Worker	Adult	Ingestion	Quant	Future supply wells could draw on contaminated aquifer, and workers may use groundwater as drinking water while at work.*
		Air	Water Vapors at Showerhead	Resident	Adult	Inhalation	Quant	Future water supply wells could draw on contaminated aquifer, and residents may be exposed to volatile chemicals from groundwater while showering or during other household use.
					Child (0-6 yrs)	Inhalation	Quant	Future water supply wells could draw on contaminated aquifer, and residents may be exposed to volatile chemicals from groundwater while showering or during other household use.

Quant = Quantitative risk analysis performed.

* While any users of water supply wells could be exposed to contaminated groundwater, residents and site workers are expected to use the water more frequently than other potential receptors (e.g., visitors) and therefore have the greatest exposure.

TABLE 8

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Montclair/West Orange & Glen Ridge Radium Sites - Essex County, NJ

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (2) (MM/DD/YYYY)
METALS										
Barium	Chronic	7.0E-02	mg/kg/day	0.07	4.9E-03	mg/kg/day	Kidney	3	IRIS	02/07/02
** Chromium	Chronic	3.0E-03	mg/kg/day	3E-02	7.5E-05	mg/kg/day	GI Tract	900	IRIS	01/03/02
Iron	Chronic	3.0E-01	mg/kg/day	--	3.0E-01	mg/kg/day	GI Tract/Liver	1	NCEA	05/01/02
Lead	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
* Manganese	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	CNS	3	IRIS	02/07/02
Zinc	Chronic	3.0E-01	mg/kg/day	--	3.0E-01	mg/kg/day	Blood	3	IRIS	02/07/02
RADIONUCLIDES										
Gross Alpha	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
Gross Beta	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
Ra-226	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
Ra-228	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
Radon-222	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
Th-228	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
Th-230	NA	NA	NA	--	NA	NA	NA	NA	NA	NA
** U-233 & U-234	Chronic	3.0E-03	mg/kg/day	--	3.0E-03	mg/kg/day	Body weight/CNS	1000	IRIS	06/06/02
** U-235 & U-236	Chronic	3.0E-03	mg/kg/day	--	3.0E-03	mg/kg/day	Body weight/CNS	1000	IRIS	06/06/02
** U-238	Chronic	3.0E-03	mg/kg/day	--	3.0E-03	mg/kg/day	Body weight/CNS	1000	IRIS	06/06/02

NCEA - National Center for Environmental Assessment

IRIS = Integrated Risk Information System; February and June 2002

HEAST = Health Effects Assessment Summary Tables; July 1997

RfD = Reference dose

NA = Not applicable

(1) The dermal RfD was assumed to equal the oral RfD, unless an adjustment factor was found in Exhibit 4-1 of EPA 2001c.

(2) IRIS values were confirmed against the EPA's online database, February 2002. NCEA values were provided by EPA, May 2002.

* The RfD of 2e-2 mg/kg/day applies to nondietary exposures, and was calculated from the IRIS RfD of 1.4e-1 mg/kg/day as recommended in IRIS. Dietary exposure (5 mg/day) was subtracted and a modifying factor of 3 was applied.

** Based on the RfD for Uranium, soluble salts.

TABLE 9

NON-CANCER TOXICITY DATA -- INHALATION

Montclair/West Orange & Glen Ridge Radium Sites - Essex County, NJ

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/ Modifying Factors	RfC Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (2) (MM/DD/YYYY)
METALS									
Barium	Chronic	5.0E-04	mg/m3	1.4E-04	mg/kg/day	Fetus	1000	HEAST (Tab2)	07/01/97
Chromium	Chronic	1.0E-04	mg/m3	2.9E-05	mg/kg/day	Lungs	300	IRIS	37259
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	5.0E-05	mg/m3	1.4E-05	mg/kg/day	CNS	1000	IRIS	02/07/02
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
RADIONUCLIDES									
Gross Alpha	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gross Beta	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ra-226	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ra-228	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radon-222	NA	NA	NA	NA	NA	NA	NA	NA	NA
Th-228	NA	NA	NA	NA	NA	NA	NA	NA	NA
Th-230	NA	NA	NA	NA	NA	NA	NA	NA	NA
U-233 & U-234	NA	NA	NA	NA	NA	NA	NA	NA	NA
U-235 & U-236	NA	NA	NA	NA	NA	NA	NA	NA	NA
U-238	NA	NA	NA	NA	NA	NA	NA	NA	NA

NCEA - National Center for Environmental Assessment
IRIS = Integrated Risk Information System; February 2002
HEAST = Health Effects Assessment Summary Tables; July 1997
RfC = Reference concentration
RfD = Reference dose
NA = Not applicable

(1) Inhalation RfDs were calculated from Inhalation RfCs assuming a 70 kg individual has an inhalation rate of 20 m3/day.
(2) IRIS values were confirmed against the EPA's online database, February 2002.

TABLE 10

CANCER TOXICITY DATA -- ORAL/DERMAL

Montclair/West Orange & Glen Ridge Radium Sites - Essex County, NJ

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (2) (MM/DD/YYYY)
METALS								
Barium	NA	NA	--	NA	NA	D	IRIS	02/07/02
** Chromium	NA	NA	--	NA	NA	D	IRIS	01/03/02
Iron	NA	NA	--	NA	NA	--	NA	NA
Lead	NA	NA	--	NA	NA	B2	IRIS	02/07/02
Manganese	NA	NA	--	NA	NA	D	IRIS	02/07/02
Zinc	NA	NA	--	NA	NA	D	IRIS	02/07/02
RADIONUCLIDES								
Gross Alpha	NA	NA	--	NA	NA	A	R-HEAST	04/16/01
Gross Beta	NA	NA	--	NA	NA	A	R-HEAST	04/16/01
Ra-226 + D	3.86E-10	$(pCi)^{-1}$	2.00E-01	NA	NA	A	R-HEAST	04/16/01
Ra-228 + D	1.04E-09	$(pCi)^{-1}$	2.00E-01	NA	NA	A	R-HEAST	04/16/01
Radon-222	NA	NA	--	NA	NA	A	R-HEAST	04/16/01
Th-228 + D	3.00E-10	$(pCi)^{-1}$	--	NA	NA	A	R-HEAST	04/16/01
Th-230	9.10E-11	$(pCi)^{-1}$	2.00E-04	NA	NA	A	R-HEAST	04/16/01
U-233 & U-234 (3)	7.18E-11	$(pCi)^{-1}$	5.00E-02	NA	NA	A	R-HEAST	04/16/01
U-235 & U-236 (4)	7.18E-11	$(pCi)^{-1}$	5.00E-02	NA	NA	A	R-HEAST	04/16/01
U-238 + D	8.71E-11	$(pCi)^{-1}$	5.00E-02	NA	NA	A	R-HEAST	04/16/01

NCEA - National Center for Environmental Assessment

IRIS = Integrated Risk Information System; February 2002

R-HEAST = Radionuclide Health Effects Assessment Summary Tables; April 2001

CSF = Cancer slope factor

NA = Not aplicable

+ D = Includes the risk contribution from decay products, assuming decay products in equilibrium with parent.

(1) R-HEAST States that the GI absorbtion factors should not be used to adjust ingestion slope factors for radionuclides. No adjustment factor was applied.

(2) IRIS values were confirmed against the EPA's online database, February 2002.

(3) CSF for U-233 is used. The CSF for U-234 is 4.44E-11 $(pCi)^{-1}$.

(4) CSF for U-235 + D is used. The CSF for U-236 is 4.21E-11 $(pCi)^{-1}$.

EPA Weight of Evidence:

A - Human Carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available.

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.

C - Possible human carcinogen

D - Not classifiable as human carcinogen

E - Evidence of noncarcinogenicity

TABLE 11

CANCER TOXICITY DATA -- INHALATION

Montclair/West Orange & Glen Ridge Radium Sites - Essex County, NJ

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (1) (MM/DD/YYYY)
METALS							
Barium	NA	NA	NA	NA	D	IRIS	02/07/02
Iron	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	B2	IRIS	02/07/02
Manganese	NA	NA	NA	NA	D	IRIS	02/07/02
Zinc	NA	NA	NA	NA	D	IRIS	02/07/02
RADIONUCLIDES							
Gross Alpha	NA	NA	NA	NA	A	R-HEAST	04/16/01
Gross Beta	NA	NA	NA	NA	A	R-HEAST	04/16/01
Ra-226 + D	NA	NA	1.16E-08	(pCi)-1	A	R-HEAST	04/16/01
Ra-228 + D	NA	NA	5.23E-09	(pCi)-1	A	R-HEAST	04/16/01
Radon-222 + D	NA	NA	7.57E-12	(pCi)-1	A	R-HEAST	04/16/01
Th-228 + D	NA	NA	1.43E-07	(pCi)-1	A	R-HEAST	04/16/01
Th-230	NA	NA	2.85E-08	(pCi)-1	A	R-HEAST	04/16/01
U-233 & U-234 (2)	NA	NA	1.16E-08	(pCi)-1	A	R-HEAST	04/16/01
U-235 & U-236 (3)	NA	NA	1.05E-08	(pCi)-1	A	R-HEAST	04/16/01
U-238 + D	NA	NA	9.35E-09	(pCi)-1	A	R-HEAST	04/16/01

NCEA - National Center for Environmental Assessment
IRIS = Integrated Risk Information System; February 2002
R-HEAST = Radionuclide Health Effects Assessment Summary Tables; April 2001
CSF = Cancer slope factor
NA = Not aplicable
+ D = Includes the risk contribution from decay products, assuming decay products in equilibrium with parent.

(1) IRIS values were confirmed against the EPA's online database, February 2002.
(2) CSF for U-233 is used. The CSF for U-234 is 1.40E-8 $(pCi)^{-1}$.
(3) CSF for U-236 is used. The CSF for U-235 is 1.30-8 $(pCi)^{-1}$.

EPA Weight of Evidence:
A - Human Carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen
D - Not classifiable as human carcinogen
E - Evidence of noncarcinogenicity

TABLE 12
FINAL RISK SUMMARY - REASONABLE MAXIMUM EXPOSURE
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Receptor	Exposure Routes	Cancer Risk	Notes on Risk	Non-Cancer Hazard Index	Notes on Hazard Index (HI)
Adult Resident	Groundwater - Ingestion - Dermal Contact - Inhalation while showering	2E-03	Inhalation of Radon-222 while showering (risk = 1.5E-03) accounts for 98% of the total RME cancer risk. Exceeds EPA's generally acceptable risk range.	1.6	The HI for gastrointestinal tract (HI = 1.1) slightly exceeded 1, primarily due to iron.
Child Resident	Groundwater - Ingestion - Dermal Contact - Inhalation while bathing	1E-03	Inhalation of Radon-222 while bathing (risk = 1.2E-03) accounts for 99% of the total RME cancer risk. Exceeds EPA's generally acceptable risk range.	3.7	The following HIs exceeded 1: - HI of 2.3 for liver, due to iron - HI of 2.6 for gastrointestinal tract, primarily due to iron.
Adult-Child Resident	Same as above	3E-03	Sum of the adult and child cancer risks. Exceeds EPA's generally acceptable risk range.	NA	Adult and child noncancer HIs should not be summed. See separate HIs for adult and child.
Site Worker	Groundwater - Ingestion	1E-05	Ingestion of Radium-228 (risk = 8.9E-06) and Radium-226 (risk = 2.5E-06) account for 90% of the total RME cancer risk. Within EPA's generally acceptable risk range.	0.5	HI value is below 1.

Cancer risks: An excess lifetime cancer risk of 1E-06 indicates that an individual experiencing the reasonable maximum exposure has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifeti

Noncancer hazards: EPA Risk Assessment Guidance for Superfund (EPA 1989) states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects.

TABLE 13
FINAL RISK SUMMARY - CENTRAL TENDENCY EXPOSURE
MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
ESSEX COUNTY, NEW JERSEY

Receptor	Exposure Routes	Cancer Risk	Notes on Risk	Non-Cancer Hazard Index	Notes on Hazard Index (HI)
Adult Resident	Groundwater - Ingestion - Dermal Contact - Inhalation while showering	2E-05	Inhalation of Radon-222 while showering (risk = 9.4E-06) and ingestion of Radium-228 (risk = 6.3E-06) and Radium-226 (risk = 1.8E-06) account for 95% of the total RME cancer risk. Within EPA's generally acceptable risk range.	1.1	HI values for all target organs were below 1.
Child Resident	Groundwater - Ingestion - Dermal Contact - Inhalation while bathing	1E-05	Inhalation of Radon-222 while bathing (risk = 9.2E-06) and ingestion of Radium-228 (risk = 1.2E-06) account for 95% of the total CT cancer risk. Within EPA's generally acceptable risk range.	1.5	The following HIs equaled or slightly exceeded 1: - HI of 1.0 for gastrointestinal tract, primarily due to iron.
Adult-Child Resident	Same as above	3E-05	Sum of the adult and child cancer risks. Within EPA's generally acceptable risk range.	NA	Adult and child noncancer HIs should not be summed. See separate HIs for adult and child.
Site Worker	Groundwater - Ingestion	3E-06	Ingestion of Radium-228 (risk = 2.2E-06) and Radium-226 (risk = 6.3E-07) account for 90% of the total RME cancer risk. Within EPA's generally acceptable risk range.	0.5	HI value is below 1.

Cancer risks: An excess lifetime cancer risk of 1E-06 indicates that an individual experiencing the reasonable maximum exposure has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifeti

Noncancer hazards: EPA Risk Assessment Guidance for Superfund (EPA 1989) states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects.

<u>APPENDIX III</u>

ADMINISTRATIVE RECORD INDEX

MONTCLAIR/WEST ORANGE AND GLEN RIDGE RADIUM SITES
GROUND WATER OPERABLE UNIT
ADMINISTRATIVE RECORD FILE
INDEX OF DOCUMENTS

3.0 REMEDIAL INVESTIGATION

3.3 Work Plans

P. 300001 - 300183 Report: Draft Work Plan, Volume I, Montclair/West Orange and Glen Ridge Radium Sites, Groundwater Remedial Investigation, Essex County, New Jersey, Work Assignment No. 036-RICO-02A9, prepared by COM . Federal Programs Corporation for the Environmental Protection Agency, October 25, 2000.

3.4 Remedial Investigation Reports

P. 300184 - 300326 Report: Final Remedial Investigation Report, Montclair/West Orange and Glen Ridge Radium Sites, Essex County, New Jersey, Work Assignment No. 036-RICO-02A9, Volume I, prepared by COM Federal Programs Corporation for the Environmental Protection Agency, January 31, 2003.

P. 300327 - 300436 Report: Final Human Health Risk Assessment, Montclair/West Orange and Glen Ridge Radium Sites, Groundwater Remedial Investigation, Essex County, New Jersey, Work Assignment No. 036-RICO-02A9, prepared by COM Federal Programs Corporation for the Environmental Protection Agency, February 3, 2003.

4.0 FEASIBILITY STUDY

4.3 Feasibility Study Reports

P. 400001 - 400089 Report: Final Focused Feasibility Study Report, Montclair/West Orange and Glen Ridge Radium Sites, Essex County, New Jersey, prepared by COM Federal Programs Corporation for EPA Region 2, June 10,. 2005.

10.0 PUBLIC PARTICIPATION

10.9 Proposed Plan

P. 10.00001- 10.00008 Superfund Proposed Plan: Montclair/West Orange and Glen Ridge Radium Sites, Essex County, New Jersey, prepared by EPA Region 2, June 2005.

APPENDIX IV

RESPONSIVENESS SUMMARY

SUMMARY OF COMMENTS AND EPA'S RESPONSES

This Responsiveness Summary provides a summary of comments and concerns involving the groundwater investigation and remedy selection process for the groundwater at the Montclair/West Orange and Glen Ridge Radium sites along with EPA's responses. Most of the comments identified below were received during the public meeting held on June 29, 2005. All comments summarized in this document have been considered by EPA in its final decision to select a no action remedy for the groundwater.

Comments from Public Meeting on June 29, 2005

Comment 1: EPA's material indicates that the Town of Montclair is receiving most of its drinking water from Wanaque [surface water reservoir] and it is unlikely that groundwater resources in the vicinity of the sites will be further developed and, thus, people will not be drinking this groundwater. The town has initiated the process of obtaining a water allocation permit from the New Jersey Department of Environmental Protection to develop its Nishuane well which is located about 500 or 1,000 feet from some of the previously-contaminated soil. It is a deep well, but some pump testing will be done in the next couple of months, causing drawdown from the effect of pumping. EPA's material indicates that the shallow and the deep water bearing zones are hydraulically connected. Will the enhanced suction from pumping this well cause travel times to the well to change and will radon concentrations increase because the well is drawing water from a larger part of the aquifer?

Response 1: EPA has conducted a thorough evaluation of the radon levels in many Brunswick aquifer wells located in and around the Montclair/West Orange and Glen Ridge Radium sites. A comparison of the on-site groundwater sampling data to the regional or background groundwater data shows no distinguishable difference in radon levels. These data indicate that discarded material from the radium industry no longer represents a source of radon in the groundwater. EPA believes that the radon levels observed in groundwater both near the excavated soil areas at the sites and in more distal areas result from natural sources in the bedrock and from anthropogenic sources such as coal ash. Therefore, testing and use of the Nishuane well by the Town of Montclair should produce groundwater with radon levels comparable to the regional background for the Brunswick aquifer. Increased suction from pumping should not affect the radon levels in the groundwater.

Comment 2: What is the connection between the Nishuane well and the shallow zone?

Response 2: EPA believes that the bedrock aquifer is hydraulically connected to the shallower zone and the two zones act as a single aquifer. No confining layers were identified that would prevent groundwater from moving downward from the surface into the deeper bedrock aquifer. EPA tested monitoring wells completed in the shallower zones above the bedrock as well as wells completed in the bedrock itself. Groundwater radon levels in the shallower zones were similar to those found in the bedrock Brunswick aquifer. While pumping of the deep Nishuane well (400 feet) may draw groundwater from shallower zones of the aquifer, the amount is expected to be minimal. And, even if shallow groundwater is pulled into the production well, the radon levels are consistent with background levels.

Comment 3: I have lived in my home for the past 30 years and want to live there for another 20 to 30 years. Considering EPA's shower scenario, what are my risks?

Response 3: The shower scenario conducted as part of EPA's human health risk assessment is conservative and assumed that the individual is bathing or showering with the groundwater from the sites. No residents have actually been exposed to this groundwater, since all homes in the affected areas are supplied with public water. Water companies or departments are required to test the water before it is distributed to consumers, to ensure that it meets all standards and requirements. If groundwater is used as part of the public water supply, the radon levels in the site groundwater are not distinguishably different from the radon levels in groundwater from other parts of the aquifer. Therefore, no increased health impacts could be attributed to the groundwater at the sites.

Comment 4: Did EPA compare a wet season or a few wet seasons to a few dry seasons to determine if the amount of rain actually caused any difference in the amount of radon in the groundwater?

Response 4: Samples were collected from the monitoring wells in July and October 2001. Samples were not collected specifically to represent dry or wet seasons, although the weather was different in October than in July. However, since radon decays at a constant rate that is not dependent on weather or seasonal conditions, the levels of radon in the aquifer should remain relatively constant regardless of seasonal or weather variations. The amount of radon that is produced depends on the amount of parent material - radium-226 - present.

Comment 5: Would the community benefit from a study of the possible connection between the new production well that may be brought on line and EPA's data, to answer finally and forever whether there will be any seepage or connection or additional contamination between the sites and the new well, and whether over the next several years, the concentration of radon-222 will increase because of the drawdown or the cone of influence?

Response 5: Each aquifer has a classification that is established by the State of New Jersey. The aquifer here is classified for use as a potable water supply. Certain standards or criteria apply to the water in the aquifer. The groundwater beneath the sites meets all drinking water standards for compounds with standards. Radon is an issue because it has been detected in all monitoring wells and no standard currently exists. With regard to the radon risks at the sites, the first and more serious concern involved radon gas moving up through the soil and becoming trapped inside homes where it could create an inhalation problem. Removing the radioactive soil removed this risk. The second concern dealt with whether the radioactive soil had any impact on the groundwater. Through all the groundwater sampling and evaluation of a wide range of available data, EPA has demonstrated that, if there ever was an effect on the groundwater from the contaminated soil, it has been removed. EPA's evaluation indicates that the quality of the groundwater on-site is essentially the same as the groundwater quality off-site. Groundwater radon levels in the shallow part of the aquifer, in the deeper part of the aquifer, and throughout the region, are similar.

EPA also reviewed groundwater conditions at the nearby US Radium Superfund site. The levels of radon there are actually higher in the deeper portion of the aquifer than in the

shallower zones due to the natural bedrock. Whether water is withdrawn from the top or the bottom of the bedrock aquifer, groundwater radon levels in the vicinity of the sites are about the same as everywhere else in the region. EPA has removed the radium-contaminated soil, which is one potential source of radon. The remaining sources of radon in groundwater are associated with natural sources throughout the area.

Comment 6: It was indicated that the shallow water-bearing zone would exit at Wigwam Brook and possibly Second River. Has any evidence been observed of radiological compounds exiting into the brook?

Response 6: EPA recently collected sediment samples at two downgradient points to determine if contaminated material had been transported to those areas or if the surface waters were being affected by the discharge of groundwater. No radionuclides above soil cleanup criteria were detected in any of those samples.

Comment 7: The conversation tonight has focused primarily on the water supply for Montclair, but there are two other communities that are also impacted by this no action decision. I wanted to find out whether they are also drawing water from similar water supplies and whether the conditions that exist in West Orange and Glen Ridge are the same as in Montclair?

Response 7: EPA's groundwater investigation covered all three communities. The groundwater sampling results were similar for all wells, indicating similar radon levels throughout the area.

EPA actually cleaned up contaminated soil in five towns. They have different sources of drinking water as follows:

Montclair - Water is supplied by the North Jersey Water Supply Commission. In addition, Montclair pumps water from three wells within the town at the following locations:

- **Glenfield well, located on Bloomfield Avenue (206.5 feet deep);**
- **Lorraine well, located on North Mountain Avenue and Lorraine Avenue (349.7 feet deep); and**
- **Rand well, located on North Fullerton Avenue (279.5 feet deep).**

West Orange - Water is supplied by the New Jersey American Water Company. Treated water is also purchased from the Passaic Valley Water Commission and from the American Water Canoe Brook treatment plant in Millburn, New Jersey.

Glen Ridge - Water is supplied by the Town of Montclair.

Bloomfield - Water is purchased from the Newark Water System.

East Orange - Water is supplied from 18 wells completed in the Brunswick Formation located in Milburn and Livingston, 12 miles from East Orange. The wells are on 2,400 acres in Florham Park, in a different watershed than East Orange. East Orange periodically

supplements the municipal water with bulk purchases from Newark Water or New Jersey American Water. Both of these suppliers utilize surface water sources.

Comment 8: How can it be explained that, at times, the water is so full of chlorine that you can't drink it?

Response 8: Chlorine is commonly used by public water suppliers to disinfect the water and ensure that it is free of bacteria prior to distribution to users. The presence of the chlorine is not related to the radon in the groundwater.

Comment 9: What was the radon level in the groundwater before remediation of the soil and would the difference between then and now be due to the removal of the contaminated soil?

Response 9: Samples were collected from the same monitoring wells in 1992, just as the soil remediation was beginning. The radon levels in the 1992 samples were very similar to the radon levels in the samples collected in 2001. The similarity in the results indicates that the radioactive soils had little or no impact on the radon levels in the groundwater. A strong acid process was used by the local radium industry to extract the radium from the soils before they were deposited throughout the area. Although the residual soil still contained some radium and other radiological contaminants, further leaching of these contaminants from the soil into the groundwater as a result of contact with ordinary rainwater would be expected to be minimal. EPA testing has shown this to be the case.

Comment 10: During the period when soils were being removed, did groundwater monitoring indicate any spike in groundwater radon levels that could have been attributable to the soils?

Response 10: No, although only limited groundwater testing was performed during the period.

Comment 11: Is there any potential contaminant in the excavated soil other than radium that would be a cause of concern that might be in the groundwater?

Response 11: The soils from the radium industry dumped throughout the area were contaminated solely with radionuclides.

Comment 12: Assuming that the excavated soil, in fact, did impact the groundwater to an extent that cleanup was warranted, what would have been the remedy?

Response 12: If a plume of contaminated groundwater were identified above EPA or New Jersey standards, a common remedy would be to extract the groundwater from the subsurface, treat the contaminants with a suitable technology, and then return the treated, clean water to the subsurface or to a surface water body. Alternatively, contaminated groundwater can also be sent off-site to a waste water treatment plant. The exact approach employed would depend on the particular circumstances at the site.

Comment 13: What would it have cost to treat the groundwater and how long would the process have taken?

Response 13: It is difficult to estimate hypothetical costs and time frames since they would be impacted by a number of factors such as the volume of contaminated groundwater, the number of extraction wells that would be needed, the type of treatment that would effectively remove the contamination, and the length of time that an extraction and treatment system would have to be in operation.

Comment 14: How did EPA identify the properties that were remediated? Would there be any problem building a house on land outside of the areas investigated by EPA?

Response 14: EPA was very conservative in identifying the areas where soil from the radium industry had been placed. We conducted aerial tests for gamma radiation utilizing a helicopter to locate the impacted areas. We performed extensive ground testing for gamma radiation both inside and outside homes, as well as radon testing inside homes to determine those properties affected by the contaminated soil. We even obtained old photographs of the area from Thomas Edison's laboratory which illustrated local conditions at the time. The point is that EPA used a variety of methods to identify those properties in need of remediation. Even after we thought that we knew the extent of the radiological contamination, we continued to test. We moved outward from affected areas to make sure that we were not leaving any contaminated soil behind. That is why the site boundaries and our cleanup expanded into Bloomfield. Consequently, residents should not be concerned that soils from the radium industry are on properties outside of the areas addressed by EPA.

Comment 15: The materials about the EPA testing and studies are all available at the library. However, those materials are quite voluminous and it is quite an undertaking to review them in the library. Is it possible to obtain the information from EPA instead of going to the library?

Response 15: There is a substantial amount of information available about the project and EPA has made a considerable effort to ensure that the public has full access to it. If residents have specific questions or requests for information, we will attempt to provide that information. In addition, we are also available to meet with anyone interested in site activities or to discuss any issues regarding the project during the public availability sessions scheduled on July 12 and 13.

Comment 16: Assuming that the no action remedy moves forward for the groundwater, what is EPA's estimate for possible deletion of the sites from the Superfund NPL list?

Response 16: Deletion of the sites from the NPL involves a number of steps. At these sites, EPA is addressing both soil and groundwater issues. The groundwater decision must be finalized and the soil cleanup must be completed before the deletion process can be initiated. At this point, we believe that all of the soil that needs to be removed has been and that all of the affected properties have been restored. However, we are still waiting for the results of long-term radon tests at a few properties that have been more recently cleaned up. The radon test results are needed before EPA can certify that all necessary cleanup actions have been taken. The only other work that remains to be done is to restore the office trailer compound EPA that has been using on Oak Street in the Town of Montclair. The trailers have to be removed and the grounds restored according to the town's preferences. Once EPA completes

these tasks and we are certain that no other work needs to be done, we then consider construction complete. The process to move from construction completion to formal deletion is primarily an administrative one for EPA that usually takes from six months to a year.

Comments via Email

Comment 17: Why are the documents only available in the West Orange Mayor's Office, when in both Montclair and Glen Ridge, the public library holds the documents for public viewing?

Response 17: The repositories for the groundwater documents are the same as those used throughout the extensive soil investigation and cleanup program implemented by EPA over the last two decades. The West Orange Health Department at the Mayor's Office has a full set of documents for all phases of the project.

Comment 18: EPA remediated my back yard over the past several years. I also had an oil tank removed from my front yard. Test data related to the oil tank removal by CERS of NJ was reported to EPA with a recommendation for no further action. However, EPA has said that since there was a sheen on the water (apparently, this can happen when installing a temporary well from the hydrocarbons), remediation of the groundwater should be undertaken to eliminate the sheen. What standard is EPA using for the groundwater? EPA is saying that no action is necessary for the groundwater at the sites. I have to ask why the oil tank is not part of the EPA Superfund project which involved my yard for the past several years?

Response 18: EPA's No Action decision is based on evaluating whether contaminants associated with the radium industry and the radioactive soils deposited throughout the area have caused contamination of the groundwater. Contaminants in groundwater that may have originated from an underground oil storage tank are different than the radioactive contaminants associated with the radium industry. In fact, CERCLA does not authorize the Superfund program to address such oil contamination from underground storage tanks. At Superfund sites, EPA determines the appropriate actions necessary to address contaminants known to be related to the particular site in question. For the Montclair/West Orange and Glen Ridge sites, those contaminants are radionuclides. EPA's No Action decision for the groundwater at the sites is based on the absence of radium and other radionuclides above regulatory standards in the groundwater. EPA also conducted extensive evaluations of radon in groundwater, both in wells close to the soil excavation areas and in wells at more distant locations. These evaluations indicate that groundwater radon levels near the soil excavation areas are not distinguishably different from radon levels in wells beyond these areas and as far as 15 miles away from the sites. In fact, the radon levels observed in site monitoring wells are similar to the levels in other wells drawing water from the Brunswick aquifer in other areas of New Jersey. Therefore, a No Action remedy for the groundwater is appropriate. Also, it is EPA's policy under the Superfund program not to remediate background levels of constituents in groundwater.

Comment 19: Please send a copy of the summary and maps if available in electronic format. Is there a web address where the report is posted? At first glance, natural attenuation appears to be the preferred solution if there are no basement sumps or receiving waters impacted by the contaminated groundwater. Also, please provide electronic versions of the CAD files prepared for all of the RI/RA plans and bid documents as a valuable mapping and surveying tool for Montclair and Glen Ridge. EPA promised this information to former Mayor Plate and it has not yet been delivered. This mainly relates to survey base maps, control points, topo plans of the study areas, metes and bounds surveys of the affected and surrounding properties, utility plans and the like.

Response 19: EPA provided hard copies of all Administrative Record documents associated with the groundwater RI/FS to the representative for Montclair and Glen Ridge. In addition, EPA and the Army Corps of Engineers provided complete design and as-built files for the work completed in Glen Ridge. The files were either on compact disk (CD) or paper copies.

Comments via Mail

EPA received one letter with comments, from the Town of Montclair Environmental Commission. The letter and EPA's response are attached to this Responsiveness Summary.

Montclair Environmental Commission
Township of Montclair

205 Claremont Avenue
Montclair, New Jersey 07042
201-392-8900 ext. 3341

July 28, 2005

BY FACSIMILE 973-361-3174
And US MAIL

Mr. Fred Cataneo, Project Manager
New Jersey Remediation Branch
Emergency and Remedial Response Division
United States Environmental Protection Agency
290 Broadway, 19th floor
New York, New York 10007-1866

Re: Montclair Radium Sites
Comments on Proposed No Action Plan for Groundwater

Dear Mr. Cataneo:

The Montclair Environmental Commission ("MEC") submits the following comments on the proposed no action plan for groundwater at and near the Montclair Radium sites:

1. **On one of the slides presented during the June 29th public meeting, the USEPA stated that the "Site groundwater unlikely to be developed as a source of potable water." Likewise, on page 7 of the USEPA June 2005 public document describing the basis for the no action plan for groundwater, it is stated that "In addition, all homes in the communities that comprise the site are supplied with public water from off-site sources. Since the groundwater beneath the sites is not used for household purposes, this indoor air radon exposure pathway also does not exist."**

   In fact, as was discussed during the night of the public meeting, the Township of Montclair is now going through the process of bringing a new drinking water supply well on-line. The new well, the so-called Nishuane well, is located within 500 feet or so of the locus of many of the formerly contaminated sites. On page 4 of the June 2005 public document, it is further stated that the unconsolidated and bedrock aquifers are hydrologically connected to some degree.

The Montclair Environmental Commission's comment, by way of question, is whether the USEPA's conclusion remains the same now knowing that the Township is planning to bring a new bedrock drinking water supply well on-line? Will the pumping effect and resultant cone of influence result in concentrations in excess of the 2000 pCi/l screening level used for purposes of performing the risk assessment?

2. Risk Assessment Screening Level

Please explain how the 2000 pCi/l Radon 222 risk assessment standard was developed. Please identify any other risk assessment standards that were considered. For comparative purposes, what are the most stringent and most lenient state standards that the USEPA is aware of? If the most stringent state standard was not used, please explain why not.

3. Radon Abatement Control Technology

Finally, assuming that the Township of Montclair brings the Nishuane drinking water supply well on-line, what Radon 222 gas abatement control technology does the USEPA recommend be used to abate Radon 222 risk?

Thank you for this opportunity to comment and we look forward to your replies.

Sincerely,

James Sherman, Chairmen
On behalf of The Montclair Environmental Commission

C: Mayor Ed Remsen
Council Liaison Robin Schlager
Town Manger Joe Hartnett
Water Bureau Director G. Obzarny
S. Pinkard, MEC
MEC Commissioners

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

August 3, 2005

Mr. James Sherman, Chairman
Montclair Environmental Commission
Township of Montclair
205 Claremont Avenue
Montclair, New Jersey 07042

Dear Mr. Sherman:

We are replying to your letter of July 28, 2005 outlining the Montclair Environmental Commission's comments on the Proposed Plan for groundwater at the Montclair/West Orange and Glen Ridge Radium sites.

In your letter, comments and questions are presented in three parts, the first of which deals with the statements by EPA that the groundwater beneath the sites is not used and unlikely to be developed as a source of potable water. As you pointed out at the public meeting and again in your letter, the Township of Montclair intends to bring on line a new drinking water supply well located within 500 feet of formerly-contaminated areas. You are concerned that pumping the new well may draw shallow groundwater with dissolved radon-222 from beneath the sites. Please be assured that, if the new well system actually can draw in the shallow groundwater associated with the clean soils in the formerly-contaminated areas, such water would be similar in quality to groundwater throughout the region. In fact, EPA's preference for the no action remedy is based on the fact that the groundwater at the sites contains radon-222 at levels similar to background while meeting drinking water standards for site-related contaminants.

The second part of your letter concerns the groundwater radon-222 level used in the Human Health Risk Assessment (HHRA). As pointed out in the Proposed Plan, there is no federal or state regulatory standard for radon-222 in drinking water. The 2000 pCi/L used for the risk assessment is not a drinking water standard, as you appear to indicate, but it is a statistical value calculated from the monitoring well data. The calculation says that the probability of finding a value greater than 2000pCi/L in a set of data from sampling the site wells is very low. Therefore, 2000 pCi/L is used as the exposure point concentration in the calculation to estimate risk.

In the third part of your letter, you ask EPA to recommend a radon-222 gas abatement control technology, presumably for handling the gaseous effluent from a groundwater aeration system being considered for the new supply well. As was stated at the public meeting, EPA believes that the aeration system can be engineered, without control technology, such that the gaseous effluent is quickly diluted to background radon levels. Consistent with that expectation is the finding in the HHRA that the potential risk from radon-222 to people from future use of local groundwater arises only from exposure in an enclosed shower room and not throughout the house where dilution can quickly occur.

Thank you for your comments and questions regarding the Proposed Plan for groundwater at the Montclair/West Orange and Glen Ridge Radium sites.

Sincerely,

Ferdinand C. Cataneo

Ferdinand C. Cataneo, Project Manager
New Jersey Remediation Branch

APPENDIX V

STATE CONCURRENCE LETTER

State of New Jersey

Department of Environmental Protection
Site Remediation and Waste Management Program
P.O. Box 413
Trenton, New Jersey 08625-0413

Richard J. Codey
Acting Governor

Bradley M. Campbell
Commissioner

SEP 13 2005

Mr. William J. McCabe
U.S. Environmental Protection Agency, Region 2
290 Broadway
New York, N.Y. 10007-1866

Subject: Montclair/West Orange and Glen Ridge Radium Sites
Records of Decision for Ground Water Remediation

Dear Mr. McCabe,

The New Jersey Department of Environmental Protection concurs with USEPA's selected "No Action" remedies for ground water at the Montclair/West Orange Radium Site and the Glen Ridge Radium Site.

While no further action pursuant to CERCLA is appropriate for these sites and levels of Radon-222 are within the range of natural background, current information suggests there may continue to be a low-level local contribution that is not attributable to natural background. Such contribution may need future definition which could lead to an institutional control (i.e. deed notice) in the future. If necessary, NJDEP will pursue any further action independent of the CERCLA process.

The State of New Jersey appreciates your efforts on this challenging case, and the opportunity to participate in the decision making process.

Sincerely,

Joseph J. Seebode, Assistant Commissioner
Site Remediation and Waste Management Program

Post-it™ brand fax transmittal memo 7671

To John Frisco	From Joe Seebode
Co.	Co. NJDEP
Dept.	Phone # 609/292-1250
Fax # 212/637-4439	Fax #

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